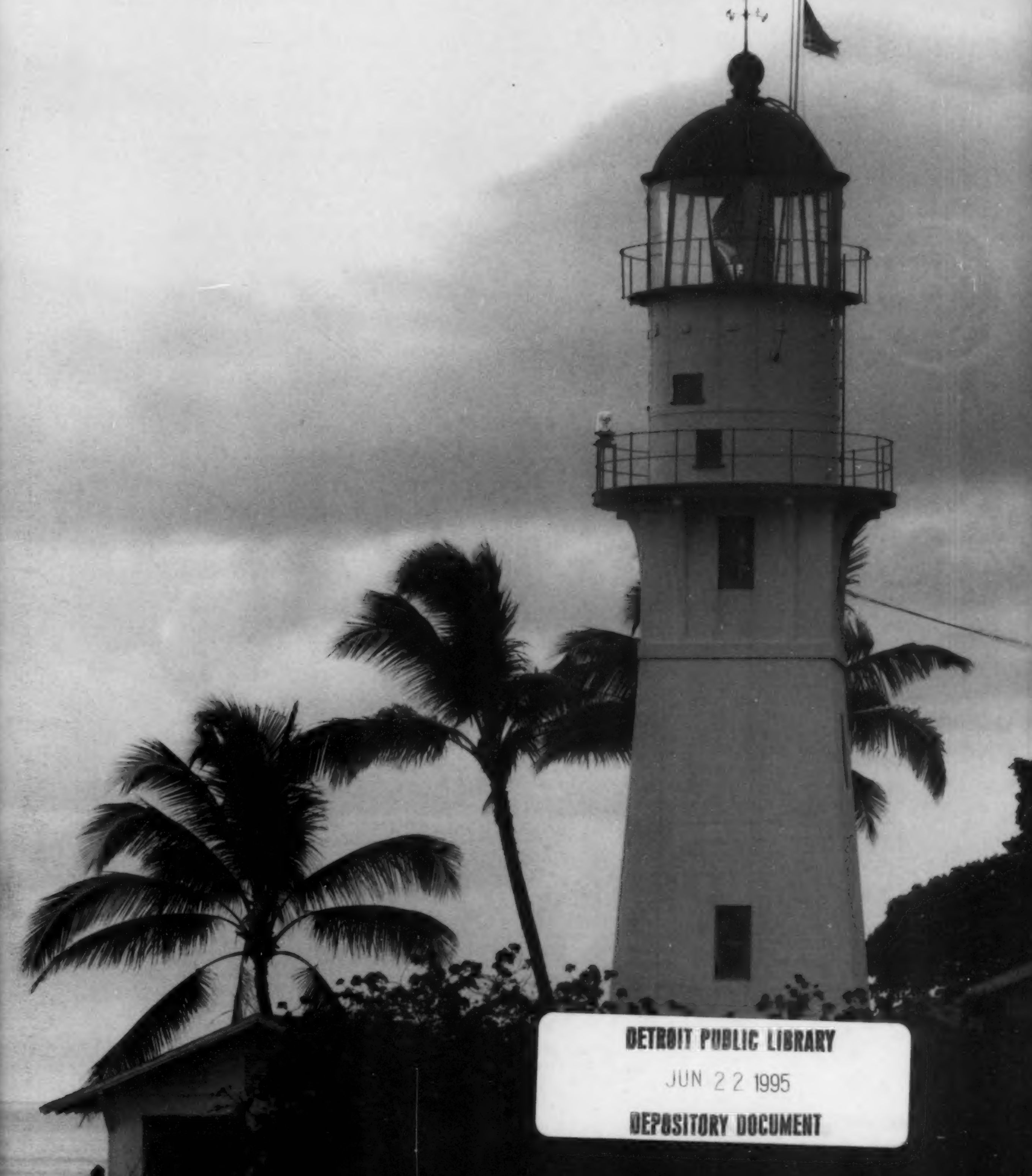
Mariners Weather Log

Spring 1995



Seul Choix Point Light Station

Lake Michigan Near Gulliver, Michigan

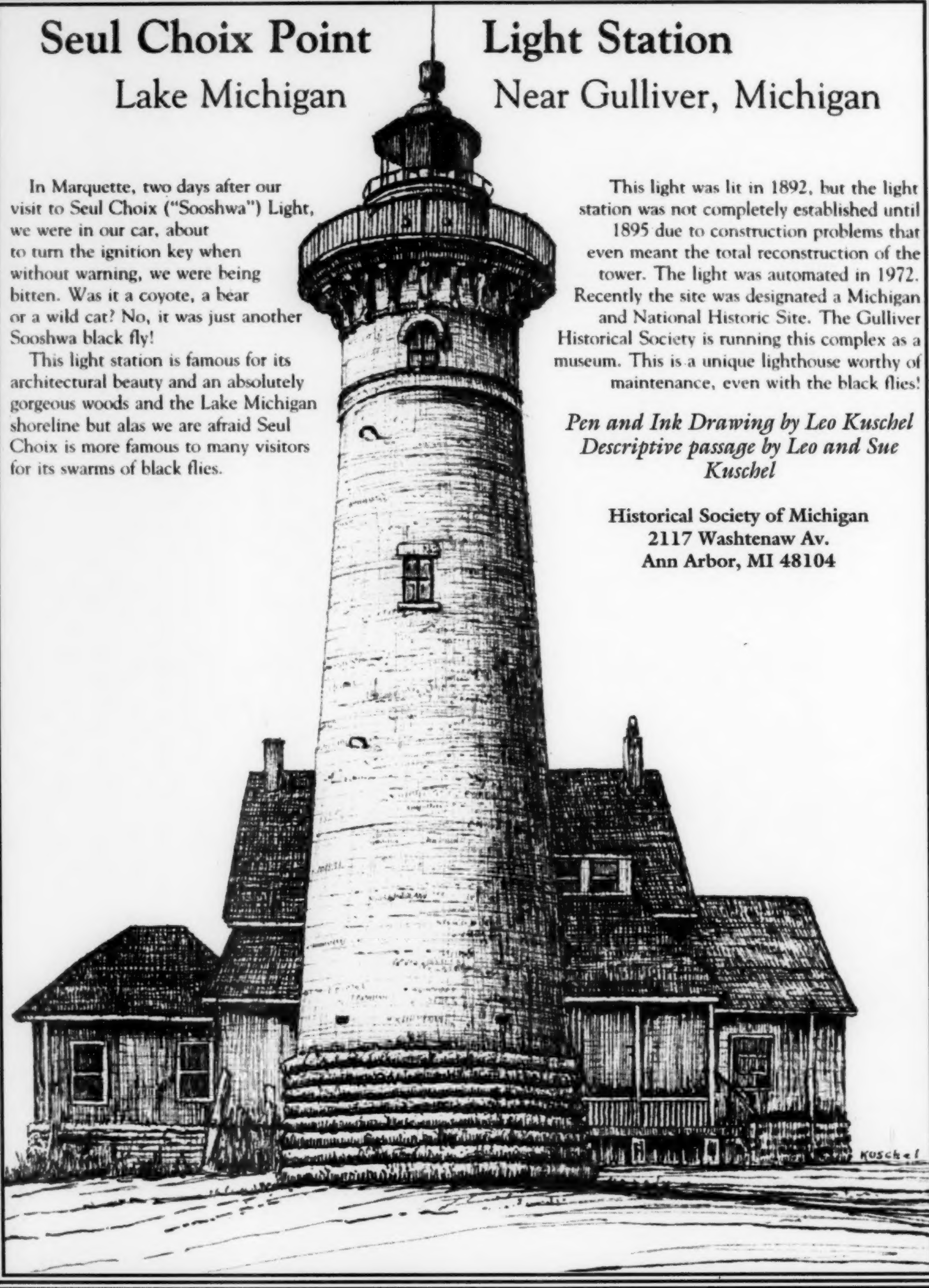
In Marquette, two days after our visit to Seul Choix ("Sooshwa") Light, we were in our car, about to turn the ignition key when without warning, we were being bitten. Was it a coyote, a bear or a wild cat? No, it was just another Sooshwa black fly!

This light station is famous for its architectural beauty and an absolutely gorgeous woods and the Lake Michigan shoreline but alas we are afraid Seul Choix is more famous to many visitors for its swarms of black flies.

This light was lit in 1892, but the light station was not completely established until 1895 due to construction problems that even meant the total reconstruction of the tower. The light was automated in 1972. Recently the site was designated a Michigan and National Historic Site. The Gulliver Historical Society is running this complex as a museum. This is a unique lighthouse worthy of maintenance, even with the black flies!

Pen and Ink Drawing by Leo Kuschel
Descriptive passage by Leo and Sue Kuschel

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104



Mariners Weather Log

Cover: Diamond Head Lighthouse is captured by the lens of columnist Elinor De Wire during her travels to the island of Oahu, Hawaii. The lighthouse, built in 1899, has as its backdrop the imposing mountain of Diamond Head. De Wire's travels has resulted in a new book on lighthouse keepers.

Back Cover: *St. Sch. Hanley* wrecked against the shore of Bolinas, California in November 1914 when the vessel lost its fight against the wild North Pacific. Photo courtesy of the San Francisco Maritime National Historic Park.

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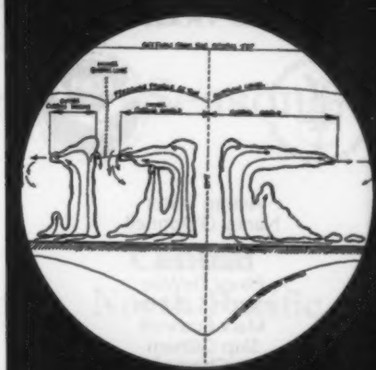

Intertropical Convergence Zone—pg. 26

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Marine Weather Review
October, November & December 1995

Mariners Weather Log

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July 1, 1995.

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Articles, photographs and letters should be sent to:

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Washington DC 20235.

A Message from the Chief

F.W. Reichelderfer
Vol. 1, Number 1, January 1957

This is the first issue of the *Mariners Weather Log*. It is published to fill a long recognized need to furnish information to mariners on the weather affecting marine commerce. The weather reports received from vessels at sea have always been essential to the success of our mission of recording, analyzing, forecasting and summarizing the weather. Without the cooperation of the masters and men of our vast Merchant Marine in providing regular weather observations and records our task would be impossible.

The Weather Bureau has traditionally summarized weather affecting agriculture in the Weekly Weather and Crop Bulletin. Now we are launching this publication series to provide information of a similar nature to a vital section of our national commerce, the maritime interests.

We hope you will find the series of interest and value. We will continually strive to improve it and will welcome your comments.

We felt that this was an appropriate time to run the very first editorial that appeared in the Mariners Weather Log. *In the current climate of cuts and savings, services to the marine community are under fire on several different fronts. There is a real threat of privatization staring at the National Weather Service as well as other government agencies. The problem with privatizing marine services is that it is not a very cost-effective process when you consider what goes into providing forecasts and warnings. Not that any lifesaving service should be counted in dollars.*

The collection of marine observations, as we have always stressed, is very important to a number of disciplines, including forecasting, research, climate analysis and defense. The weather service has estimated that the cash value of marine observations from voluntary ships is in excess of $6 million per month, and they also estimate that the loss of the Mariners Weather Log *would result in at least a 30 percent decrease in ship observations. To those who think that ground truth is no longer necessary in the satellite age, take a look at the Mail Call column in this issue to see just how misleading photographs can often be. While the* Log *is still going strong, the threat of cuts are very real.*

Tropical Cyclone Names for the Northern Hemisphere 1995 Season

North Atlantic	Eastern North Pacific	Western North Pacific	Central North Pacific
Allison	Adolph	Chuck	Huko
Barry	Barbara	Deanna	Ioke (ee-OH-keh)
Chantal	Cosme	Eli	Kika
Dean	Dalila	Faye	Lana
Erin	Erick	Gary	Maka
Felix	Flossie	Helen	Neki
Gabrielle	Gil	Irving	Oleka
Humberto	Henriette	Janis	Peni
Iris	Ismael	Kent	Ulia
Jerry	Juliette	Lois	Wali
Karen	Kiko	Mark	
Luis	Lorena	Nina	
Marilyn	Manuel	Omar	
Noel	Narda	Polly	
Opal	Octave	Ryan	
Pablo	Prisilla	Sibyl	
Roxanne	Raymond	Ted	
Sebastien	Sonia	Val	
Tanya	Tico	Ward	
Van	Velma	Yvette	
Wendy	Wallis	Zack	
	Xina	Angela	
	York	Brian	
	Zelda	Colleen	
		Dan	
		Elsie	
		Forrest	

Gulf of the Farallones National Marine Sanctuary

Nancy O'Donnell
National Oceanographic Data Center

On Southeast Farallon island, the largest of the 7-mile island chain within the Gulf of Farallones National Marine Sanctuary boundaries, some 26,000 Western Gulls nest each year. Harbor and elephant seals, California sea lions along with 27 species of dolphins and whales flourish too in its waters. Contributing to the wealth of bird and marine life is the fortunate combination of weather patterns in this area of the northern Pacific, just off the California coast. Northwest gales and southerly ocean currents work in tandem with the earth's rotation and draw warm surface water offshore. The cold water pulled up from below brings vast quantities of nutrients that fertilize the microscopic plant life at the surface. In this fertile upwelling, swarms of young fish, squid and shrimp thrive in the abundant field of plants and, in turn, become food for larger marine animals.

The Gulf of the Farallones, 948 square nautical miles of marine and estuarine habitat, was designated a marine sanctuary in 1981. The largest population of harbor seals, elephant seals, and California sea lions reside there. Among the multitude of marine species are the threatened Guadalupe fur seal and Steller sea lion and the endangered blue, fin, and humpback whales. California gray whales pass through on their way to breeding grounds farther south and return to rest with their calves in Drake's Bay.

Not one, but many worlds are found in the sanctuary, on the edge of the continental shelf off Central California. The Farallones, a Spanish word which translates as "rock rising from the sea," rest some 25 miles west of the Golden Gate Bridge and are home to nearly a quarter of a million seabirds and marine mammals. Nurseries and spawning grounds for Dungeness crab, Pacific herring, sole and rockfish are found within the sanctuary.

The Gulf of the Farallones is the fifth in a series of articles on U.S. National Marine Sanctuaries. The Farallones Islands, alternately shrouded in fog and battered by northwest gales, are home to a vast wealth of bird and marine life and the scientists who study them.

Gulf of the Farallones
National Marine Sanctuary
Fort Mason, Building. 201
San Francisco, California 94123

A Farallon tufted puffin

Near shore the sanctuary contains the waters of Bodega, Tomales and Drake's Bays and Bolinas Lagoon, Estero de San Antonio, Estero Americano, and Duxbury Reef. These nearby coastal wetlands, lagoons, salt marshes, and tidal flats teem with life. Shorebirds such as Willets, sandpipers, sanderlings, and godwits feed on the crustaceans that populate rich, sandy tide pools. Scientists come to study the animal populations while tour boats circle the area on gray, blue, and humpback whale spotting expeditions. This peaceful coexistence of man and wildlife has not always been the case. At the turn of the century, the bird population was nearly decimated when 14 million eggs were harvested by San Francisco entrepreneurs and Russian ships were hunting for fur seal skins and whale blubber.

This wealth of nature attracted the Coast Miwok tribes, who depended on marine resources for their trade and livelihood. The Miwoks for the most part supported over 100 communities near the calm waters of the bays and esteros. They wove tule mats to cover the rounded skeleton of willow poles and redwood bars to build huts. They hunted for deer inland and turned to the sea for fish and shellfish. The abundance of food allowed them leisure time. They worshiped a supreme world-creator, Coyote, and other gods and created secret societies that used dance to honor the spirit inhabitants of their world.

The Miwok culture flourished on San Francisco Bay until the arrival of Spanish missionaries in 1820. The Spanish settlers that soon followed brought European diseases and changes in land tenures that led to the eventual destruction of the tribes.

The British seaman, Sir Francis Drake, sailing aboard the ***Golden Hind*** was also drawn to the white cliffs of northern California during his voyage of circumnavigation. Drake found a "fit and convenient harbour" at 38° north on June 17, 1579. His reason for stopping was threefold. He was being pursued by the Spanish for relieving the vessel ***The Lady of Conception*** of a vast quantity of South American gold. He was also

The cliffs of northern California are as imposing today as they were for Sir Francis Drake in 1579, reminding him, he wrote, of the cliffs of Dover in his homeland. Pursued by the Spanish, he stopped to repair his ship, the Golden Hind *somewhere along the coast.*

searching for the mythical "North-west Passage" and his ship was badly in need of repair.

Records report that Drake was reminded of the cliffs of Dover when he spied the white cliffs of northern California and named the place "Nova Albion" using the language of English poets who called Great Britain, Albion. Some claim Drake landed as far north as Trinidad Bay, others name Bolinas Bay, or say he passed through the Golden Gate and found a harbor near San Quentin. The most convincing of all arguments is noted in *Sir Francis Drake and the Golden Hind:* "The Drake Estero [was] the most likely place...the sandy beach would certainly have served his purpose well and the sheltered inlet would have given Drake vital screening from the prying eyes of his enemies while he stripped down his ship to repair her. It would also have allowed adequate opportunity...to defend his famous stockage..."

During his 5-week stay, Drake maintained amiable relations with the natives and made a number of excursions inland. He also "replenished his larder by drawing upon the great store of seals and birds" on the Farallon Islands. From there he struck off for England crossing the Pacific Ocean through the Islands of the East Indies.

Notwithstanding Drake's incursion, the Spanish retained possession and influence. They named a menacing point which rises some 183 meters above the ocean and now holds the Point Reyes Lighthouse, *La Punta de los Reyes* or the Point of Kings.

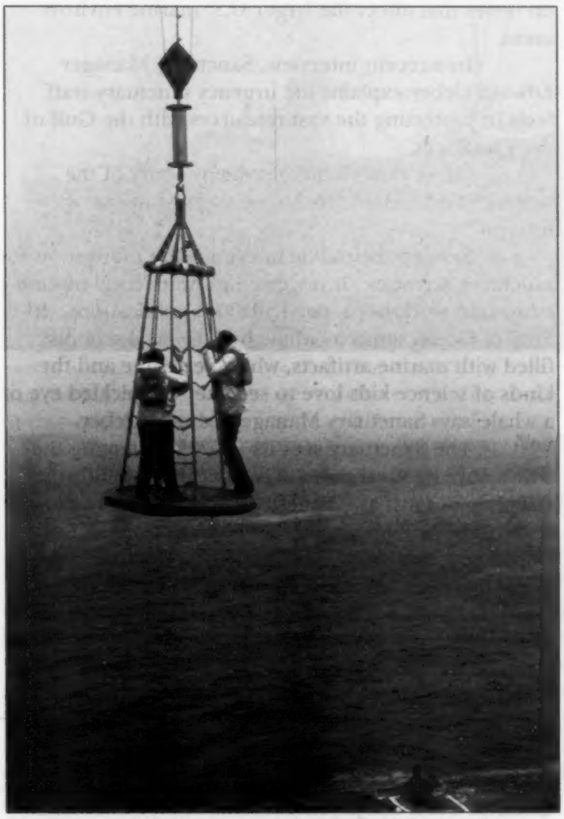
Hundreds of years of shipwrecks mark these waters as dangerous. Point Reyes is described as the nation's windiest headland, and it often receives the full brunt of hurricane force northwesterlies. Cold fogs that cover the area 9 months out of the year add another complication; it is perhaps the foggiest part of the coastal U.S. The area is plagued by currents that move in opposite directions, and a steep sea floor that did not allow early sailors to test depth or position but sent vessels to a breaking beach or jagged rocks without warning. The earliest recorded shipwreck, in 1595, was the Spanish Manila Galleon ***San Augustin*** which sank in Drake's Bay. Its final resting place is still a mystery today because conditions around the site prevent exploration. Between 1840 and 1940, 72 other marine disasters have been recorded.

While these waters are merciless to mariners, the surrounding bays all serve as protection. Immune to the brunt of ocean storms, these coastal waters allow skates, starry flounder, halibut, anchovies, herring and rockfish to thrive. The bays, estuaries and intertidal areas have received greater attention from the sanctuary in recent years as freshwater toxicity from commer-

cial activities in coastal and inlet waters has increased.

Seabirds are an ever present symbol of the sanctuary's mission whether swirling overhead or nesting and feeding. The largest concentration of breeding seabirds in the continental U.S. –the Common Murre, cormorants and auklets– live on this curving coast line. Seabird colonies far from land provide scientists with the opportunity to study the cycle of avian life: flying, diving below the water surface for food and resting on the open ocean.

Due to the vulnerability of marine birds and mammals, much is done to protect them from human encroachment. The Farallones National Wildlife Refuge, where the greatest number of seabirds nest, is not open to the public but can only be viewed from boats. When boats bring supplies to the scientists working on Southeast Farallon, a resident biologist goes out in a small motor boat to meet them. The few visitors to the islands must be lifted from the motor boat by a platform dangling from a crane since no dock is allowed. Low flying aircraft are now prohibited from flying near the Refuge.



Scientists cannot dock to prevent injury to the bird populations. Instead they're transported to shore on a platform.

California's largest breeding population of harbor seals slide through sanctuary waters. Pinnipeds such as the California sea lions, northern elephant seals, northern or Steller sea lions, and northern fur seals can haul out safe from human harm. In the open ocean, schools of migrating whales, porpoises, sea lions and seals travel the sanctuary waters.

Gray whales are frequently seen as they travel from their summer feeding grounds off Alaska in the Bering Sea and Arctic Ocean to winter breeding lagoons along Baja California. These mammoth bottom feeders reach 14 meters in length and weigh up to 50 tons at maturity (10–14 years).

Life in the Gulf of Farallones was not always so bucolic. A hundred years ago, before the U.S. created a reserve in 1909, the island birds were nearing extinction.

Writer Chris Coursey describes the destruction of whole populations during the California Gold Rush when entrepreneurs looked toward the island only "a day's sail outside the Gold Gates" to provide food for the great swarm of prospectors:

Eggs. Thousands of eggs ready for the snatching. According to an article in the March 1887 edition of 'Ornithologists and Oologist' more than 30,000 were taken from the Farallones during the 1850s. They sold in San Francisco for as much as a dollar a dozen.

The "Farallones Egg Company" founded in 1855 farmed April through June of each year. David G. Ainley and T. James Lewis in their *History of the Farallones Island Marine Bird Populations 1854-1972*, estimate that "the number of murre eggs taken in 45 years was well over 14 million."

Other animals were not exempt from the slaughter. From 1807 through the 1830s, American and Russian sealers ravaged the marine population on South Farallon, and the elephant seal, fur seal, and the sea otter were destroyed or driven from the island.

The California gray whale population suffered during the 1800s whaling industry. Left to recover and grow in number, whales again faced destruction during the 1920s and 1930s. Finally in 1938, an international treaty provided protection and enabled the numbers to increase although not until 1966 was whaling totally stopped in this area.

Today dangers more sophisticated than whalers or goldminers impact the marine sanctuary. Three major shipping lanes approaching San Francisco converge in the sanctuary with tankers carrying millions of gallons of oil within sight of the islands. Although oil and gas exploration and development

A rotund seal lolls on the rocks. Once hunted for their skins, the seals now enjoy some safety from two-legged predators.

beaches that attract hikers, surfers, clammers, abalone divers, surf fishermen and bird watchers. Within the shallows of the esteros, the old valleys have filled with sea water. Protected from the surf by sand bars, these shallows provide a haven for leopard sharks and bat rays while above egrets and blue herons make their slow liquid flights in search for food.

Near shore and far into the Pacific, the Gulf of the Farallones Sanctuary staff manages and protects these resources through special research and educational programs, aware that the legacy of years of plunder have had repercussions. The Common Murre and Tufted Puffins populations, for example, have never recovered.

activities within the sanctuary are prohibited, and a circular precautionary zone 11.9 nautical miles in diameter acts as protection for the islands, accidents have occurred.

More recently, in 1984, an explosion aboard the tanker ***Puerto Rican*** caused an oil spill that killed 5,000 birds. Two years later in 1986, the barge ***Apex Houston*** spilled more than 25,000 gallons of oil into the Gulf as it was being towed from San Francisco to Los Angeles. During that spill the beaches of Marin County were heavily damaged. Scores of volunteers aided in bird rescues, but it was reported that 10,000 seabirds were killed including those listed as endangered species like the Marbled Murrelet.

Perhaps the austere beauty of the Gulf of the Farallones makes the potential hazards even more disturbing. Throughout the year, wreaths of dense fog hover over large sections of the sanctuary moderating summer heat. So foggy is the area that for 200 years San Francisco Bay was invisible to Spanish voyagers who passed it but never ventured close for fear of grounding.

During winter storms, giant sneaker waves blast the sand dunes and parents are advised to never leave a child unattended on the beaches. Visitors are warned to be aware of tide schedules before they climb down the steep cliff walls to the tidepools below. Swimming is impossible here; powerful undertows have claimed the unsuspecting.

The land too is imposing, covered with tough shrubs of chaparral and coyote brush. Father north, Point Reyes provides protection and creates sheltered

Because of its environmental and cultural importance, the Sanctuary now safeguards the current inhabitants but also has assumed the role of consultant on issues that affect the larger U.S. marine environment.

In a recent interview, Sanctuary Manager Edward Ueber explains the urgency sanctuary staff feels in protecting the vast resources with the Gulf of the Farallones.

"If we don't maintain the integrity of the oceans," said Ueber, "we haven't served the public interest."

Serving the public interest is the motivation for sanctuary activities. It reviews and funds local marine education workshops, curricula and publications. Its Project Ocean sends a "whale bus" to local schools filled with marine artifacts, whale vertebrae and the kinds of science kids love to see like "the pickled eye of a whale"says Sanctuary Manager Edward Ueber.

The Sanctuary sees its task of protecting the 948 square nautical miles of water off the California coastline not just as a benefit to marine mammals and seabirds. The staff knows that commercial fishing, shipping, sportfishing, sailing, offshore nature excursions, marine scientific research and other activities can only flourish if the sanctuary maintains a careful watch over the wide expanse of water and the land that it touches.

Special thanks to NOAA Librarians Dottie Anderson and Marty Bokow; Justin Kenney, National Marine Sanctuary Program; Ed Ueber and Jan Roletto, Gulf of the Farallones NMS, for their assistance with this article.

The *Nordmeer*

Skip Gillham
Vineland, Ontario, Canada

The proud **Nordmeer** *now provides a guiding mark for mariners in the seaway. Photo courtesy of Shipsearch Marine*

Detailed navigational charts guiding ships through Lake Huron note the buoy for the "Nordmeer Wreck" some 12 miles east of Alpena, Michigan. Masters too use this buoy as a common checkpoint.

Nordmeer began its first and only visit to the Great Lakes in Fall 1966. The 143.5-meter long freighter was built in Flensburg, Germany, in 1954 and could handle almost 11,000 tons of cargo.

On this maiden transit of the seaway, ***Nordmeer*** carried 990 coils of steel and was headed to Chicago to unload the million dollar cargo.

En route up Lake Huron on November 19th, it turned inside the buoy marking Thunder Bay Shoal and, at about 2025 hours, slammed into the treacherous rocks at a speed of 14 knots. A call for help went out.

The ore carrier ***Samuel Mather*** was nearby and removed 35 sailors to safety. The Captain and seven other men remained on board hoping for possible salvage. That hope evaporated when they learned the bottom was ripped out for most of the ship's length.

On November 28, a classic fall storm hit and sealed its fate. The next day the hull broke at the third hatch. A U.S. Coast Guard helicopter removed the rest of the crew.

Later salvages removed some of the steel and, in 1969, much of 20,000 gallons of fuel was pumped out to prevent pollution.

Photo courtesy of Newsday/ K. Wiles Stabile

The Great December Nor'easter of 1992

Natural Disaster Survey Team

National Weather Service

The Great Nor'easter of December 1992 was one of the epic storms of the century. It generated a diversity of severe weather that disrupted coastal shipping and affected nearly the entire northeast quadrant of the United States.

At some locations along the northern New Jersey, New York City and Long Island coasts, tides exceeded those produced by the hurricanes of 1938, 1944, 1954 and 1960 and the great extratropical storms. Wind gusts between 50 and 78 knots whipped parts of southeastern Pennsylvania and southern New Jersey while some interior sections from West Virginia to Massachusetts were blanketed by .3 to 1.2 meters of snow. Ambrose Light just outside of New York Harbor recorded sustained winds of 70 knots with gusts to 81 knots.

Setting the Stage

A number of meteorological occurrences, both at the surface in the upper atmosphere, combined to produce this devastating storm. On the 9th of December, the eastern United States was under the influence of a building anticyclone which drifted slowly eastward across southern Canada. The following day it was centered just north of the Great Lakes and New York and provided the cold air necessary for the snow that occurred later. The surface High was associated with an upper-level ridge that extended roughly from the Gulf Coast to the Great Lakes. This upper ridge moved slowly eastward and a convergent northwesterly flow dominated the region east of the ridge axis and was associated with a 300-millibar wind maximum, or jet stream, above the Middle Atlantic Coast.

The Natural Disaster Survey Team included Team Leader Russell A. Dorr, NWS Eastern Region; Team Technical Leader, Harvey Thurm, NWS Eastern Region; Subject Matter Specialists Wilson Shaffer, NWS Office of Systems Development; and Paul Kocin, NWS National Meteorological Center; Field Representative Richard Kane, WSFO Sterling; Sylvia K. Graff, WSFO Boston; Bruce Budd NWS Eastern Region, Peter Gabrielsen, NWS Eastern Region; and Stephen Hrebenach, NWSO Tulsa.

As the 1035-millibar surface High moved to a position near Anticosti Island, off the coast of Quebec, and remained virtually stationary, the upper-level ridge reached the East Coast and stalled. During this period, a complex surface low pressure system over Texas moved northeastward and consolidated, for a short time, into a single Low over the midwestern United States. This Low was associated with an upper-level, short-wave trough moving eastward across Texas. South of the trough's axis was a jet streak with maximum winds exceeding 95 knots at 1200 (all times are UTC) on the 9th, while a band of strong upper-level winds was producing a divergent flow above the western United States.

The Nor'easter

Into this scenario came a separate surface Low from coastal Texas which crossed the Gulf Coast and moved over southeastern Georgia by 1200 on the 10th. It reached southeastern Virginia by 0000 on the 11th and the Chesapeake Bay 12 hours later. At the same time the short-wave trough over the Southern Plains began to lift northeastward toward the Ohio Valley. However, a region of cyclonic vorticity advection remained south of the center and propagated across the southeastern United States with the surface low before it had begun to intensify.

The divergent jet flow across the western United States shifted southeastward to the Central Plains and was replaced by a developing upper-level ridge. As this ridge amplified, a new trough began to take shape, upwind of the existing trough that was lifting northeastward from Texas to Ohio. This upper trough continued to strengthen and as it approached the East Coast on the 10th, the Gulf Low intensified and generated the high winds, torrential rains and heavy snowfall that marked this event. From 1200 on the 10th to 1200 on the 11th, the central pressure of the cyclone dropped about 24 millibars to 985 millibars. As the intensifying Nor'easter moved northeastward, snow changed to rain across Virginia and Maryland (except in the western mountains) and rain spread northward across eastern Pennsylvania and into Delaware and New Jersey, where 50 to 75 millimeters of liquid precipitation were common, with isolated amounts of up to 150 millimeters. The precipitation continued to advance, reaching eastern New York and northern New Jersey late on the 10th. It remained as snow across much of West Virginia and central and western Pennsylvania and snow spread into central and western New York.

As the intensifying cyclone closed in on the stationary anticyclone, the pressure gradient between the two tightened. As a result, surface wind speeds increased along the Middle Atlantic Coast. Gale to Storm Force winds spread northward from Virginia and Maryland to New Jersey and southeastern New York, where wind gusts commonly approached and occasionally exceeded hurricane force. Offshore winds were higher, as demonstrated by the 81-knot peak gust at Ambrose Light at 1600 on the 11th. The ***Marlin*** off Cape Hatteras at 0000 on the 11th ran into 45-knot winds in 5-meter seas.

Then, between 1200 on the 11th and 12th, the surface Low center near the Chesapeake Bay weakened slowly and the storm began to redevelop over the Atlantic Ocean. On the evening of the 12th, the complex low pressure system continued to drift slowly eastward in the Atlantic and precipitation began to diminish. The heaviest snow had fallen across portions of West Virginia, the mountains of western Maryland and Virginia, and across much of western Pennsylvania, where amounts in excess of .5 meters were measured, with some locations in western Maryland and southwestern Pennsylvania reporting 1 meter

Photo courtesy of Bob Chartuk

At left is a ground-level view of houses on East Lifehouse Walk in Fire Island's Kismet community in Suffolk County Long Island. Above is an aerial view of the barrier beaches along Long Island's South Shore, which were no match for the storm's fury. Over the next several months, the newly-formed Pikes Inlet, connecting Moriches Bay and the Atlantic Ocean in Westhampton Beach, grew to almost 1 mile wide destroying a portion of Dune Road and dozens of beachfront homes.

The former December Monster of the Month whipped up the surf at Hull, Massachusetts on the 13th where tides breached a 100-meter section of Nantasket Beach. This scene was captured by James Redman, who has supplied the Mariners Weather Log *and* Weatherwise *with many good storm photographs in the past. Mr. Redman is a photographer from Hull.*

or more.

Strong winds over the long onshore fetch continued to produce damaging surf from New Jersey northward to Maine through the 12th. Heavy snow and high winds affected most of interior Massachusetts during the night of the 11th–12th, with many interior areas receiving in excess of .3 to .6 meters of snow, while snowfall approached 1.2 meters in some mountainous locations. Heavy rain continued near the coast and total precipitation amounts neared 200 millimeters over southeast Massachusetts. Rain began to change to snow in coastal locations from eastern Massachusetts to northern New Jersey, and these regions experienced a blustery, snowy day on the 12th.

Coastal Weather

As the Low moved through North Carolina into Virginia and deepened, wind speeds reached a maximum along the Mid Atlantic States around 0000 on the 11th. During this period, the winds at Buoy 44014, located east of the Virginia–North Carolina border, and at Chesapeake Light, near the mouth of the Chesapeake Bay, were from the southeast in excess of 39 knots with gusts to near 49 knots. Even in the more protected waters of the upper Chesapeake Bay, east winds of 33 knots gusting to 43 knots were recorded. Tides along the Virginia, Maryland and Delaware coasts were approaching high tide. However, this was the lower of the two high tides during the semidiurnal cycle, and the storm was in the midst of intensifying rapidly.

The most intense winds measured in the storm occurred between 1400 and 1600 on the 11th. The area of strongest winds had shifted northward to the south coast of New England, including the New York City metropolitan area. Sustained winds from 43 to 50 knots with gusts near 58 knots were recorded during this period as far east as Buzzards Bay Light, just south of Cape Cod, to Buoy 44025, south of Long Island. The strongest winds recorded during the entire event occurred at Ambrose Light, just south of New York Harbor, as east northeast winds of 68 knots

gusting to 81 knots were observed at 1600. Winds were nearly parallel to much of the south coast of New England; however, Long Island Sound, as it narrows from east to west, produces a funnelling effect for both wind and water coming from an easterly direction. Strong winds came directly onshore over northern New Jersey. High tide occurred for much of this region, including Long Island Sound, during or near this period of very strong winds. This was not only the higher of the two high tides for the day, but it was also the highest tide during the month.

During this time, the winds were increasing along the eastern New England coast. At Boston Large Navigational Buoy, northeasterlies reached a maximum of 45 knots with gusts to 56 knots at 0900 on the 12th. There were several subsequent peaks observed at 1400 and 2100 on the 12th and 0100 on the 13th. However, none of these peaks occurred near the time of high tide. Farther north, at Isle of Shoals off the New Hampshire coast, the winds were from the north northeast when they reached a maximum, resulting in a smaller angle of incidence to the coastline in addition to occurring near low tide.

The storm brought record snowfall to parts of interior southern New England and major coastal flooding. Waves as high as 7 meters were reported along portions of the Massachusetts east coast on Saturday. The pounding from waves during several consecutive above-normal tides took their toll. Tides breached a 100-meter section of Hull's Nantasket Beach. A peak wind gust of 46 knots was recorded Friday morning at Bridgeport Weather Service Office while a 63-knot gust was reported at Mason's Island. The Weather Service Meteorological Office at Chatham observed 52-knot wind gusts but they may have been higher since the anemometer is shadowed to the northeast by the radar dish. Otis Air Force Base in Falmouth had a peak gust of 64 knots.

Storm tides on December 11th ran about 1.0 to 1.5 meters above normal along the western Connecticut coast and 1.0 to 1.2 meters above normal along the rest of the Connecticut shoreline and .5 to 1.0 meters above normal along other parts of the southern New England coast.

Storm Damage

Property damage caused by the wind and coastal storm surge was extensive. Hardest hit were the coastal communities of Greenwich, Norwalk, Westport, Stratford and Milford.

Old Greenwich was pounded by four successive flooding tides. There were 195 homes damaged. Two offshore islands were severely impacted. Great Captain's Island lost 6 meters of shoreline and a 18-meter dock off its western end. Little Captain's Island, developed for recreational use, lost a 50-year old bathhouse, a boat landing area and 300 meters of seawall. In Norwalk at least 100 residents were carried to higher ground by firefighters during the worst flooding to strike the city in 40 years. In the Rowayton section, the flood waters were higher than any storm since the '38 Hurricane.

There was one known direct storm-related fatality in New England. A 50-year old man was killed when a homemade carport roof collapsed from the weight of heavy snow on Saturday (12th).

The most significant damage along the Massachusetts coast was reported from Chatham to Provincetown on Cape Cod, from Plymouth to Marblehead, around Gloucester and Plum Island and on Nantucket Island. Heaviest hit communities included Nahant, Revere, Winthrop, Quincy, Hull, Scituate, Chatham and Nantucket. Less tangible but no less significant, was the ecological impact from beach erosion and saltwater intrusion. Dunes were washed away in Hull and Duxbury. Three-meter dunes in Marshfield had a vertical scarp loss of 1.5 meters. As much as 6 meters of dune was lost in Sandwich and up to 8 meters at Crane's Beach in Ipswich. The Weather Service Meteorological Office at Chatham on Morris Island was cut off from the mainland by flooding for part of Saturday and Sunday.

A 180-meter freighter went aground Thursday night just after exiting the Cape Cod Canal, but it floated free on Saturday's record high tide. The grounding itself was not storm related. On Friday, the U.S. Coast Guard rescued eight crewmen from a sinking fishing boat, the scalloper ***Betty Ann***. The boat was lost in gusty winds and heavy seas off Chatham. On Saturday, pilot whale strandings were reported along Cape Cod Bay from Brewster to Truro. About 30 pilot whales swam up the Pamet River to near Truro Center. In Truro, there was a breach of Ballson Beach on the outer Cape Cod shore that reached the headwaters of the freshwater Pamet River, turning it into a salt marsh and turning Provincetown into an island. The historic Highland House near Cape Cod Light in North Truro was severely damaged, but the problems in Provincetown seemed limited. On Nantucket Island, wind-driven tides claimed six cottages and left two more severely damaged. Waves ripping through the harbor tore away 20 meters of the town dock.

The Rhode Island coast suffered significant flooding but escaped the magnitude of damage incurred along sections of the Connecticut and Massachusetts coasts. Portions of Rhode Island did suffer major beach erosion. Misquamicut on the southwest

coast suffered beach erosion up to about 15 meters inland, but impact on the structures was not as severe as in the Halloween Storm of 1991.

In the worst affected areas of New York City, Long Island and New Jersey, several successive high tides from early Friday December 11 through Monday, December 14 resulted in unprecedented flooding and coastal erosion, which may have permanently changed the coastline. The effect of this coastal flooding along with high winds caused significant damage to coastal New York and New Jersey. Widespread moderate and scattered severe coastal erosion, flooded beaches and significant dune erosion occurred. Also evident was widespread damage to houses, cars and boats.

On Long Island's North Shore, the coastal areas hardest hit were Bayville, Northport, Centerport and Port Jefferson. On the South Shore, the communities of Long Beach, Lindenhurst, Freeport, Babylon and Mastic Beach were severely impacted. In New York City, the FDR Drive, Battery Park (Manhattan) and Sea Gate (Brooklyn) were particularly impacted by tidal inundation. On the FDR Drive, police cut through the guardrails at 79th Street to let northbound motorists exit across the southbound lanes. More than 50 cars were abandoned on the FDR Drive from 60th to 96th Streets. On the Battery Park underpass, police used rafts and scuba divers to rescue 19 trapped motorists.

Staten Island's eastward facing beaches south of the Verranzano Bridge and north of the Outer Bridge Crossing experienced severe coastal erosion. Several boats were sunk or washed ashore. Eyewitness accounts mentioned that waves were breaking clear over Fire Island, while in Westhampton Beach on Long Island's South Shore, Dune Road was breached in two locations creating two new inlets.

In New Jersey, among the communities hardest hit were Union Beach, Atlantic Highlands, Sea Bright, Monmouth Beach, Sea Girt, Long Beach Island, Harvey Cedars and Longport. The community of Sea Bright in northern New Jersey experienced severe flooding and the dune system was breached in more than one spot. During the storm, the community of Union Beach witnessed 300 cars totaled from the effects of sea water. Nearby, in Atlantic Highlands, over 95% of the boats in and near the municipal piers were destroyed.

There were two storm-related deaths in New Jersey and one in New York.

Outside the areas of greatest impact there were three known direct storm-related fatalities in western Pennsylvania where roofs collapsed from the weight of the snow. In Northern Virginia, one homeless person drowned from flooding along the Rappahannock River in Stafford County and in North Carolina a man was killed by a falling tree. A 23-meter sloop bound for Bermuda from Newport, Rhode Island, was sunk by a rogue wave early Friday morning some 250 miles east of the Virginia coast. The crew of five was rescued by a tanker which was called to the scene by the U.S. Coast Guard. The crew was taken by helicopter to the Naval Air Station in Virginia Beach and treated for hypothermia.

Place in History

The Ash Wednesday Storm of 1962 remains the benchmark storm, particularly for the central and southern New Jersey coastline. In this area the Great Nor'easter of December '92 was more comparable to the March 1984 Nor'easter. Along the New York City, Long Island and Connecticut coasts, this December 1992 storm will be considered the worst in many years, perhaps since Hurricanes Donna (1960) and Carol (1954).

For the Massachusetts east coast, comparisons between the Halloween Nor'easter (October 1991) and this storm are inevitable. The overall impact from coastal flooding along the Massachusetts east coast will probably not be considered as severe as experienced in the Halloween Nor'easter of 1991 and the Northeast Blizzard of 1978. And although there were high seas with this storm, wave battery was estimated to be worse with the October 1991 storm when 9- to 12-meter seas were reported just offshore. Unlike the October 1991 storm, the strongest winds did not coincide with the time of highest tide along the Massachusetts coast, and the wind direction did not remain constant. Even though this recent storm moved rather slowly and brought coastal flooding over several tidal cycles, the October 1991 scenario appeared to have focused stronger winds over a longer fetch for a greater time period along the Massachusetts coast. Further, the Halloween Storm propagated westward which may have helped drive huge seas from the outer continental shelf onto the coastline.

This storm will take its place alongside other severe extratropical cyclones that have occasionally ravaged the East Coast of the United States and given fits to the forecasters trying to predict path and intensity. As with ocean storms both tropical and extratropical, forecasters continued to be hampered by a lack of coastal and offshore observations. In this storm limited data were available from a large area of the ocean off the northeast coast of the United States. Every observation provided is critical.

Point Reyes Lifeboat Station

Elinor De Wire
Gales Ferry, Connecticut

Sailors of old often invested inanimate objects with human qualities, no doubt to soften the hardship of separation from home and family. Certain salty adages serve as proof: *The sea is the embrace of the sailor's devoted wife, but the shore is the clutch of a cruel and scornful mistress.*

If ever a shore was such a seductive siren, Point Reyes is she. This unpredictable peninsula, 40 miles north of San Francisco, has a multitude of personalities. On any given day, it can be cloaked in fog with a cellophane-smooth sea, or pleasantly sunny and nudged by a gentle tumble of combers. It can be scoured by a steady gale, or assailed by a furious Pacific storm. And like a lady of many disguises, it can change its face quickly.

Despite its fickle disposition, trans-Pacific shipping has always regarded Point Reyes as a welcome sight after a long and tedious journey. In the days of sail, it meant landfall and the impending comforts and excitement of the San Francisco waterfront. In 1870, a lighthouse was built on the 182-meter precipice of the seaward-most part of Point Reyes. It reduced the number of wrecks, but its keeper was not equipped to handle those that did occur.

The solution came almost two decades later, with the opening of the Point Reyes Lifeboat Station – one of the first on the West Coast. It stood on Ten-Mile Beach, a low, flat strand about 2 miles north of the lighthouse. Few places were more hazardous or busier for shipping. The West Coast's first recorded shipwreck occurred here in 1595 when the Spanish galleon ***San Augustin*** ran aground and cast ashore a cargo of beeswax and silk. Nearly 50 wrecks had occurred by the time the lighthouse and lifesaving station arrived.

Ten-Mile Beach was the logical place for the lifesaving station because a long launching railway could be built to give surfmen easy access to the sea when their lifeboats were needed. But the surf on the beach was exceptionally heavy most of the year, making drills and rescues difficult. The graves of several surfmen who drowned in the 1890s are a grim reminder of the dangers at Point Reyes.

"Point Reyes is very dangerous. There is something there that draws ships in."

Captain Charles Peterson,
skipper of the steamer ***Matsonia***.

Even as recently as 1960, two Coast Guardsmen were lost during a rescue operation. They had successfully dealt with a distress call from a disabled fishing boat and were returning home to Point Reyes in the rain. The sea was rough that night, but the 11-meter motor lifeboat was a reliable craft – self-bailing, self-righting, and with sealable compartments. Coast Guard investigators believe a rogue wave hit the lifeboat and either capsized it or washed its occupants into the sea. The men were unable to get back in the boat, and it sped away without them.

The next day the lifeboat was found ashore on Point Reyes beach, its motor still running. There was no damage and no evidence of a collision or foul play. Months later the bodies of the two crewmen washed ashore. The old surfmen's motto had rung true for them: *You have to go out, but you don't have to come back.*

The Point Reyes Lifeboat Station of 1960 was very different from its 1888 predecessor. The original station occupied 3.5 acres that had been purchased from a local resident named Charles Webb. It included a boathouse and rail launch on the beach and a main house and storage building on the bluff behind the beach. The head keeper and his family, along with bachelor surfmen, resided in the main house. Married surfmen lived in shanties clustered about the station.

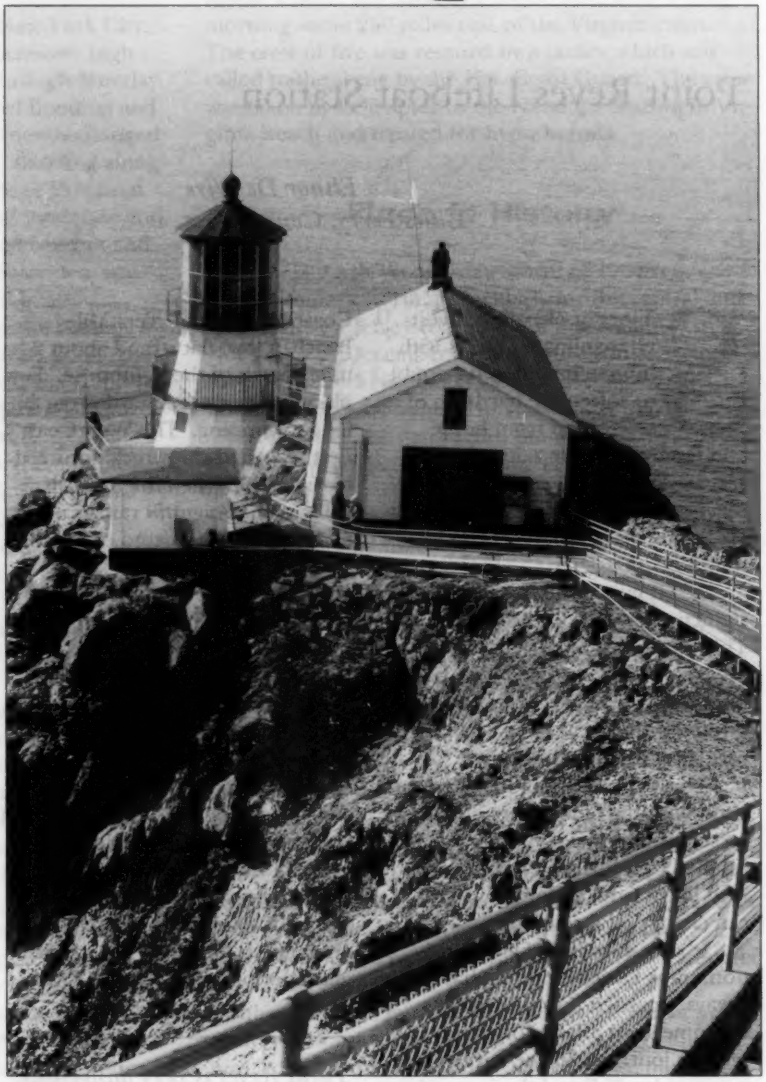
The lifeboats were pulling boats, manned by robust men who spent their days patrolling the beach, keeping a lookout posted,

and practicing their skills under the leadership of a seasoned headkeeper. Most of the drills were conducted in nearby Drakes Bay, where the surf was calmer and there was less chance for a calamity. But patrolmen pounded blustery Ten-Mile Beach for miles north and south of the station house, watchful for any sign of distress. At times the wind was so fierce, they wore goggles to protect their eyes from the flying sand.

In 1899 and 1915 two remarkable advancements marked a turning point for the Point Reyes Lifeboat Station, and the Lifesaving Service overall. The first motor lifeboat was successfully tested in 1899 along the shores of Lake Michigan. By 1905, motor lifeboats were rapidly replacing the archaic oar-driven pulling boats. Considerable modification was required to convert many older stations, including Point Reyes, so new stations were built.

This was the plan for Point Reyes, but two events intervened. The first was the merging of the Lifesaving Service and Revenue Cutter Service in 1915 to create an entirely new organization – the U.S. Coast Guard. Bureaucratic aftershocks prevented immediate action on Point Reyes new lifeboat station, and when the U.S. entered World War I, national defense eclipsed all plans to upgrade lifesaving facilities. It wasn't until 1927 that the new Point Reyes Lifeboat Station opened.

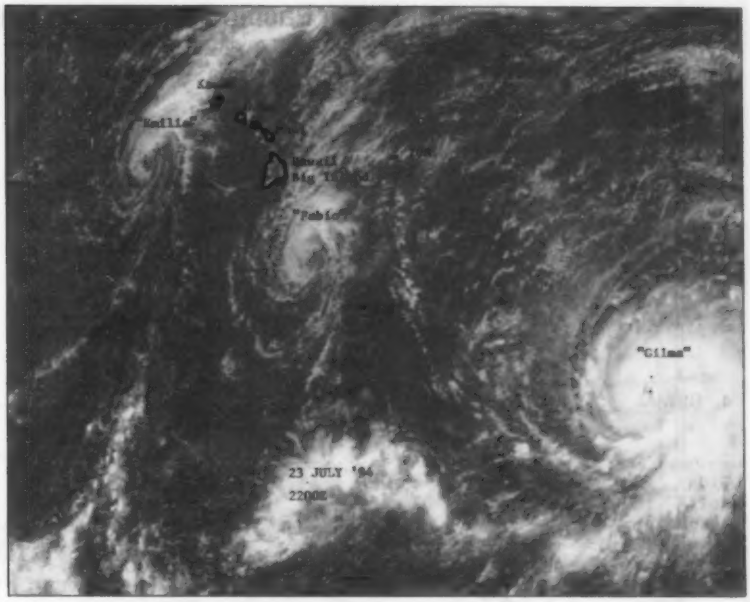
The new site was inside protected Drakes Bay, a few miles south of the original station. Coast Guard officers took command, which caused some discontent among the surfmen, but the men were happy with their new surroundings. Drakes Bay was a kinder mistress than Ten-Mile Beach had been, and the new station house had such luxuries as hot water and electric lighting. The apex of the station, however, was its 11-meter Class H motor lifeboat with a gasoline-powered winch to hoist it.



On any given day, [Pt. Reyes] can be cloaked in fog with a cellophane-smooth sea, or pleasantly sunny and nudged by a gentle tumble of combers. It can be scoured by a steady gale, or assailed by a furious Pacific storm.

The Point Reyes Lifeboat Station was decommissioned in the 1960s and given to the Point Reyes National Seashore. It has been restored and is open to the public. Lifesaving historian and author, Ralph Shanks, regards it as the best preserved example of a lifeboat station for its period. The 11-meter TRS motor lifeboat on display is the same one that was found on the beach following the loss of two crewmen in 1960. Built at Curtis Bay, Maryland in 1953, it is one of less than a dozen of its type still in existence.

Central North Pacific Tropical Cyclones —1994



Hurricane Gilma moves on a westward path south of the Hawaiian Islands while Fabio nears the Big Island and Emilia lies southwest of Kauai on July 23, 1994, 2200Z.

Staff, National Weather Service Forecast Center
Central Pacific Hurricane Center
Honolulu, Hawaii

The 1994 tropical cyclone season for the Central North Pacific was a near record one for the Central Pacific Hurricane Center (CPHC). A total of eleven tropical cyclones were observed in the Central Pacific. This total included five hurricanes (Emilia, Gilma, Li, John, and Kristy), three tropical storms (Daniel, Mele, and Nona), and three tropical depressions (Fabio, ONE-C, and Lane), that were observed in the Honolulu CPHC's area of responsibility.

The total of eleven tropical cyclones during 1994 ties the record for the greatest number of systems ever recorded in the Central Pacific area. Only the 1992 season experienced as many systems. During a normal season, about five tropical cyclones are observed in the Central Pacific. The only season with more hurricanes was the 1967 season when six hurricanes were recorded.

The 1994 season established a record for the most intense hurricanes ever recorded in the Central Pacific. Three of the hurricanes (Emilia, Gilma, and John) were accompanied by wind speeds of 135 knots or more, placing them in Category Five on the Saffir Simpson scale. This was the first time a category five had ever been observed in the Central Pacific area.

A positive sea surface temperature anomaly is suspected to be one of the major contributing factors to the above normal number of tropical cyclones in the Central Pacific this season. Sea surface temperatures in the area between 8°N and 18°N and from 120°W to 150°W were a couple of degrees Celsius above normal during much of the season. The three most intense storms generated and intensified rapidly in this area of above normal water temperatures. Normal sea surface temperatures in this region are usually just below the threshold for supporting the generation of hurricanes. A stronger than normal subtropical high pressure area over the northeast Pacific also contributed to the intensity and movement of the storms.

The season began in July with two hurricanes,

This summary is based on the 1994 Annual Tropical Cyclone Report prepared by the Central Pacific Hurricane Center. Special thanks to Glenn H. Trapp, Armando L. Garza, and Ben Hablutzel and their staff.

Central North Pacific Tropical Cyclones for 1994

Name	Dates (140°W - 180)	Class Central Pacific	Lowest Pressure (mb)	Maximum Sustained Winds (kt)	Hours Observed per class
1. DANIEL	JUL. 11-14	T.S.	994	55	HUR. = 0 T.S. = 76 T.D. = 18
2. EMILIA	JUL. 17-25	HUR.	925	140	HUR.=126 T.S. = 24 T.D. = 24
3. FABIO	JUL. 22-24	T.D.	1006	25	HUR. = 0 T.S. = 0 T.D. = 42
4. GILMA	JUL. 24-31	HUR.	925	140	HUR. = 66 T.S. = 90 T.D. = 6
5. LI	AUG. 3-12	HUR.	992	65	HUR. = 6 T.S. = 96 T.D. =126
6. ONE-C	AUG. 9-14	T.D.	1008	30	HUR. = 0 T.S. = 0 T.D. =120
7. JOHN	AUG. 20-28 SEP. 8-10	HUR.	920	150	HUR =210 T.S. = 0 T.D. = 0
8. KRISTY	AUG. 31 - SEP. 4	HUR.	970	90	HUR. = 36 T.S. = 48 T.D. = 30
9. MELE	SEP. 6- 9	T.S.	1006	35	HUR. = 0 T.S. = 48 T.D. = 36
10. LANE	SEP. 9-10	T.D.	1006	25	HUR. = 0 T.S. = 0 T.D. = 18
11. NONA	OCT. 22-25	T.S.	1006	35	HUR. = 0 T.S. = 6 T.D. =114

Class: refers to highest classification reached in Central Pacific: Hurricane (HUR) = > 64 knots, Tropical Storm (T.S.) = 34 — 63 knots, Tropical Depression (T.D.) = < 33 knots.

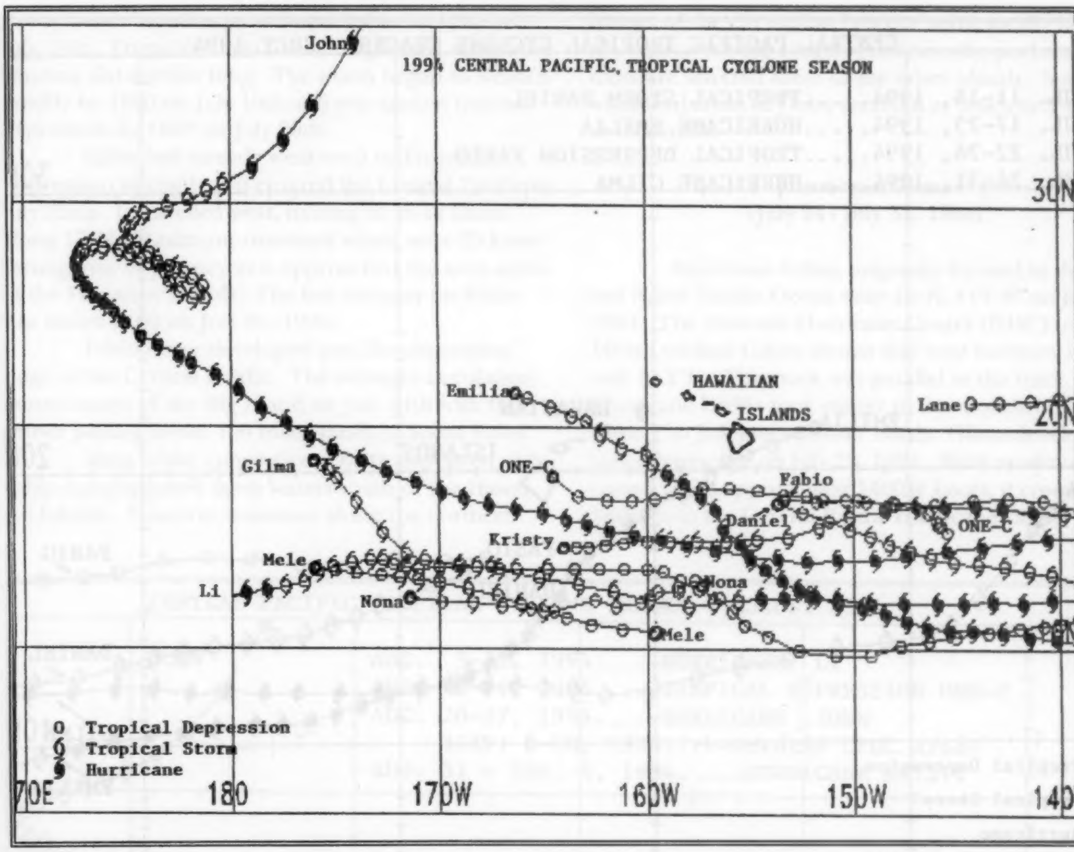
one tropical storm, and one tropical depression. The season continued active in August with three hurricanes and one tropical depression. In September, one tropical storm and one depression were observed. The season extended into October as a late season tropical storm developed in the Central Pacific.

Although none of the tropical cyclones affected the Hawaiian Islands with strong winds, the decaying stages of some of the storms did produce some significant rainfall and some high surf, mainly over the windward sections of the Big Island of Hawaii.

The table shown above provides a look at each individual storm that affected the CPHC's area of responsibility. The estimated lowest pressure, estimated maximum sustained winds derived from satellite, and the number of hours that the storm was either a hurricane, a tropical storm, or a tropical depression is provided.

Tropical Storm Daniel
(July 11 – July 14, 1994)

Daniel initially developed as a disturbance near 8.0°N, 99.0°W on July 6, 1994. It continued on a



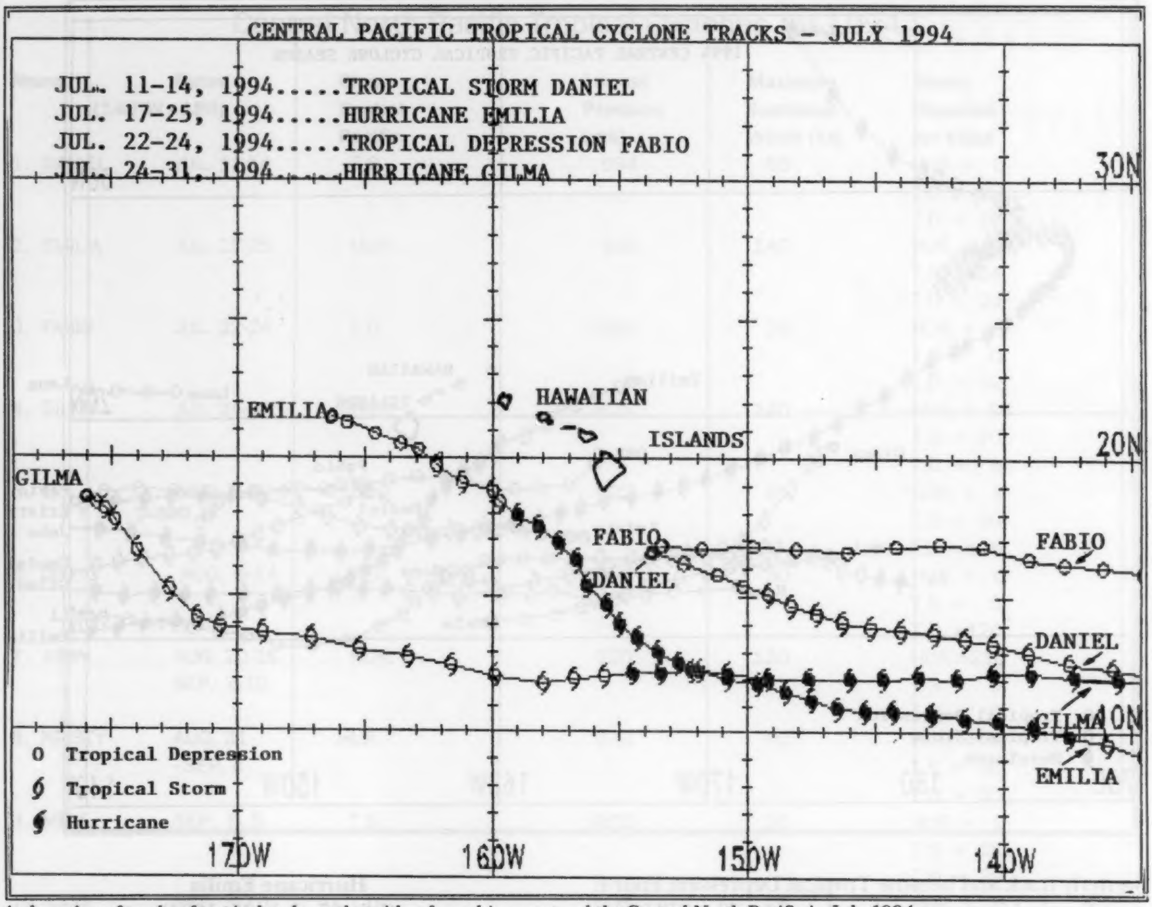
westerly track and became Tropical Depression Four-E and Tropical Storm Daniel on July 8th. The CPHC commenced issuing advisories after the storm crossed 140°W near 13°N on July 11th.

After crossing 140°W, Daniel moved toward the Hawaiian Islands with maximum winds estimated at 55 knots. This was Tropical Storm Daniel's peak intensity. Daniel crossed 140°W moving at close to 17 knots, but slowed its forward speed to just under 14 knots as it approached 145°W. It eventually began a steady west northwest track near 10 knots. The final advisory was issued on July 14th as the system continued to dissipate just south of the Big Island of Hawaii. Remnants of Daniel passed about 100 miles south of South Point on the Big Island of Hawaii on July 15th. The only effects on land were some locally heavy showers over the windward slopes of the Big Island. Rainfall totals were about 127mm in 5 hours on July 15th. Moderate surf between 1 and 2 meters also affected east and southeast facing shorelines of the Big Island on July 13th and 14th.

Hurricane Emilia
(July 17 - July 25, 1994)

Emilia was initially identified as an area of disturbed weather in the Intertropical Convergence Zone near 12°5W on July 14th. By the time Emilia crossed 140°W and into the Central Pacific on July 17th, it was already a well developed hurricane with estimated winds of 85 knots. Emilia grew rapidly in intensity to become one of the most powerful hurricanes on record in the Central Pacific. Maximum sustained winds were estimated to be 135-140 knots as it moved between 148°W and 155°W. In the Eastern Pacific, Emilia moved rapidly westward at 15-20 knots after it developed, then settled to an average forward speed of 10-15 knots as it approached 140°W. It continued to track to the west northwest at this same speed until reaching 150°W, at which time it slowed to a steady 8-10 knots as it began to take a more northwesterly track.

On its closest approach, Emilia passed about 150 miles southwest of the Big Island of Hawaii at 0600 on July 22nd. Maximum sustained winds were



A close view of tracks of tropical cyclones that either formed in or entered the Central North Pacific in July 1994

85 knots. Emilia continued to weaken, passing about 200 miles southwest of Oahu and Kauai as a tropical storm on July 23rd. The following day, Emilia continued to decrease in strength and was downgraded to a tropical depression.

The effects of this powerful hurricane on the Hawaiian Islands were minimal. There was the usual high surf of 6 to 10 feet along the Puna and Kau shorelines of the Big Island of Hawaii. Slightly lower surf was reported along the Kona and Kohala coastline and along the south facing shores of the smaller islands.

Emilia passed very close to NOAA Buoys 51002 and 51003. Observations from these two platforms provided a good hourly sampling of atmospheric pressure, as well as winds and waves during the passage.

Locally on land, winds were strong and gusty across the state where terrain brought the strong easterly winds at mountain top level down to the lower elevations. Only minor wind damage to roofs occurred and a few trees were uprooted or branches broken. Rainfall was mostly light to moderate.

By July 21st, Emilia was feeling the full force of the "decapitation" effects. Throughout the next 24 hours, Emilia became sheared and lost strength rapidly as it passed south of the Hawaiian Islands.

Tropical Depression Fabio
(July 22 - July 24, 1994)

Tropical Depression Fabio had its beginnings in the Eastern Pacific Ocean. It formed on July 19th at 0000 into Tropical Depression SIX-E out of an area of disturbed weather that had been monitored by the National Hurricane Center (NHC) in Miami for several days. The NHC indicated that depression's deep convective banding increased and then quickly

strengthened into Tropical Storm Fabio by 1200 on July 19th. Tropical Storm Fabio's organized convective banding did not last long. The storm began to weaken quickly by 1800 on July 19th and was again a tropical depression by 1800 on July 20th.

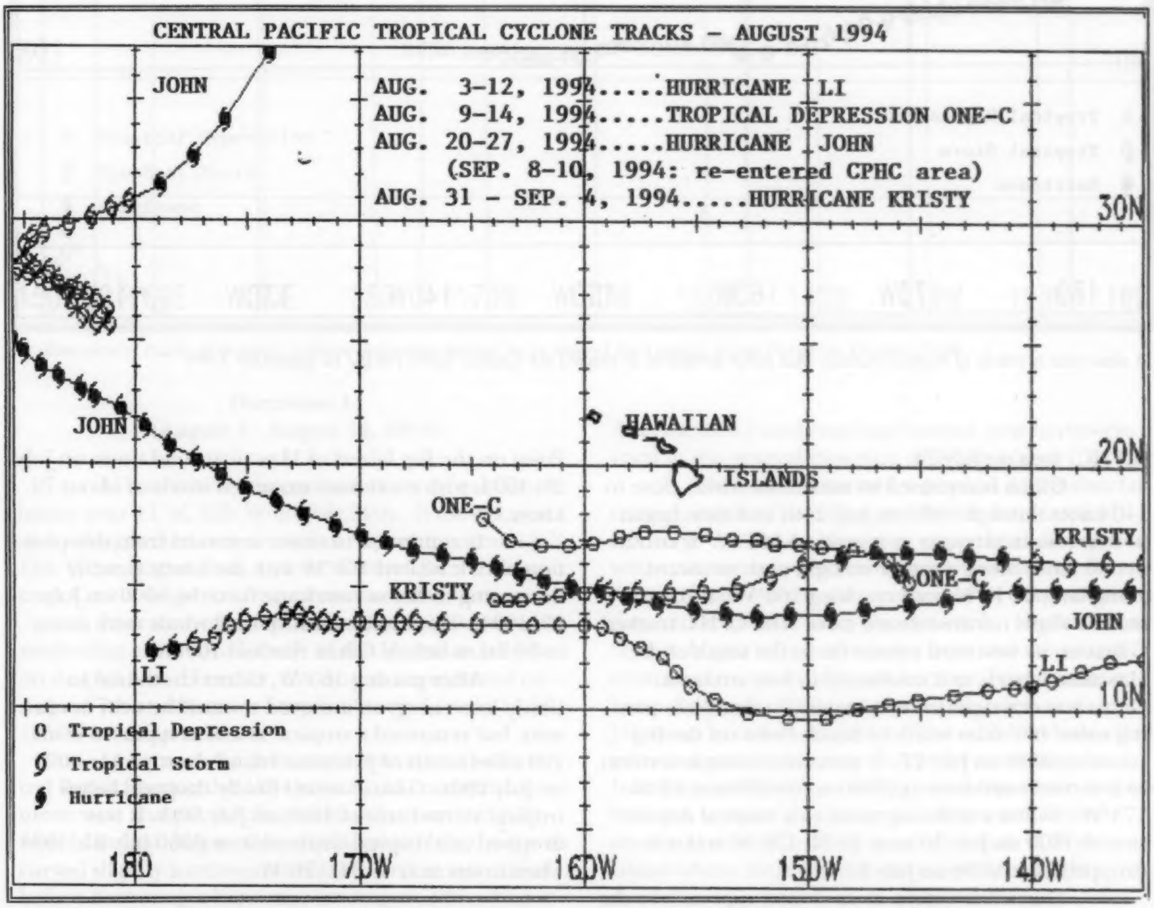
Fabio had already weakened to Tropical Depression strength as it entered the Central Pacific on July 22nd. It travelled west, moving at 16-18 knots along 17°N. Maximum sustained winds were 25 knots throughout its journey as it approached the area south of the Hawaiian Islands. The last advisory on Fabio was issued at 00 on July 24, 1994.

Fabio never developed past the depression stage in the Central Pacific. The remnant circulation moved south of the Big Island on July 24th with the center passing about 100 miles south of South Point.

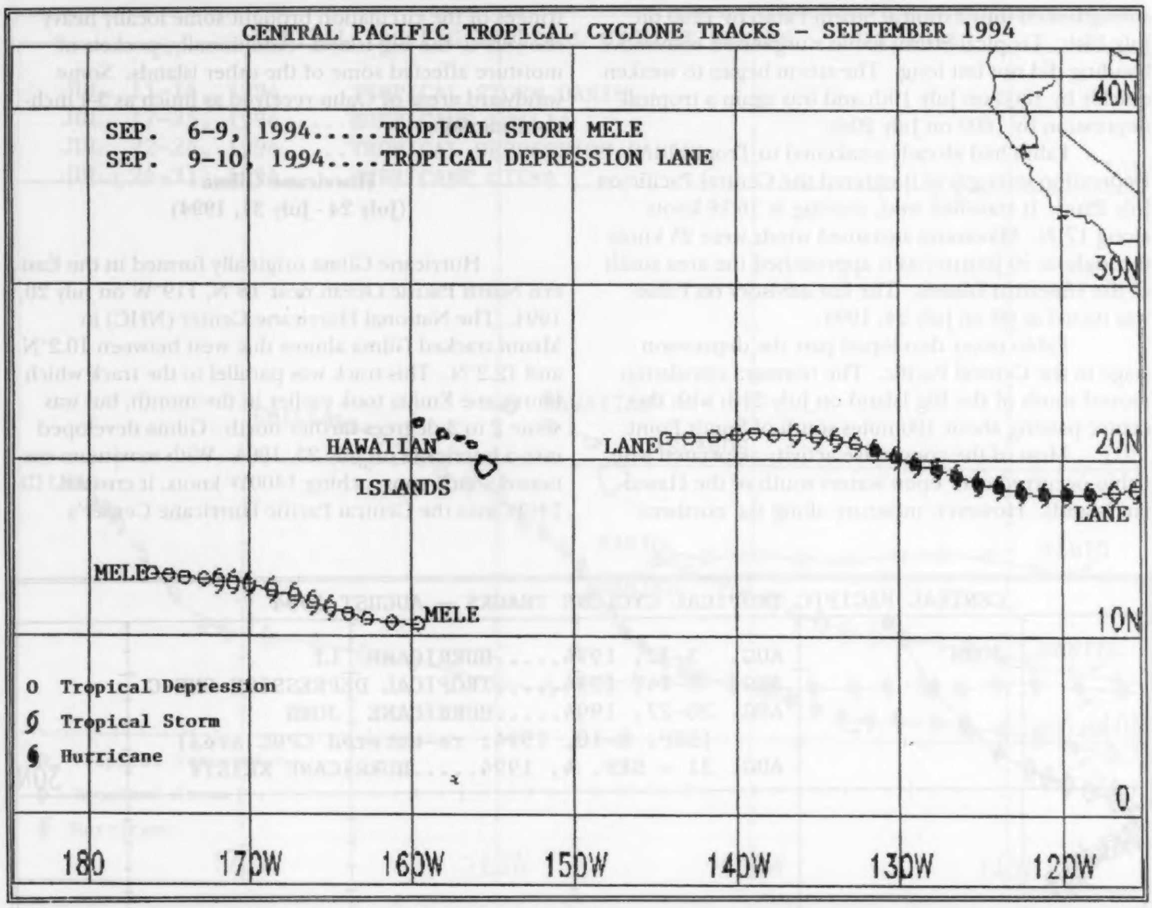
Most of the convective activity associated with Fabio occurred over open waters south of the Hawaiian Islands. However, moisture along the northern fringes of the circulation brought some locally heavy showers to the Big Island. Additionally, pockets of moisture affected some of the other islands. Some windward areas of Oahu received as much as 3-4 inches of rainfall.

Hurricane Gilma
(July 24 - July 31, 1994)

Hurricane Gilma originally formed in the Eastern North Pacific Ocean near 18°N, 119°W on July 20, 1994. The National Hurricane Center (NHC) in Miami tracked Gilma almost due west between 10.2°N and 12.2°N. This track was parallel to the track which Hurricane Emilia took earlier in the month, but was some 2 to 3 degrees farther north. Gilma developed into a hurricane on July 23, 1994. With maximum sustained winds approaching 1400W knots, it crossed 140W into the Central Pacific Hurricane Center's



A close view of tracks of tropical cyclones that either formed in or entered the Central North Pacific in August 1994



A close view of tracks of tropical cyclones that either formed in or entered the Central North Pacific in September 1994

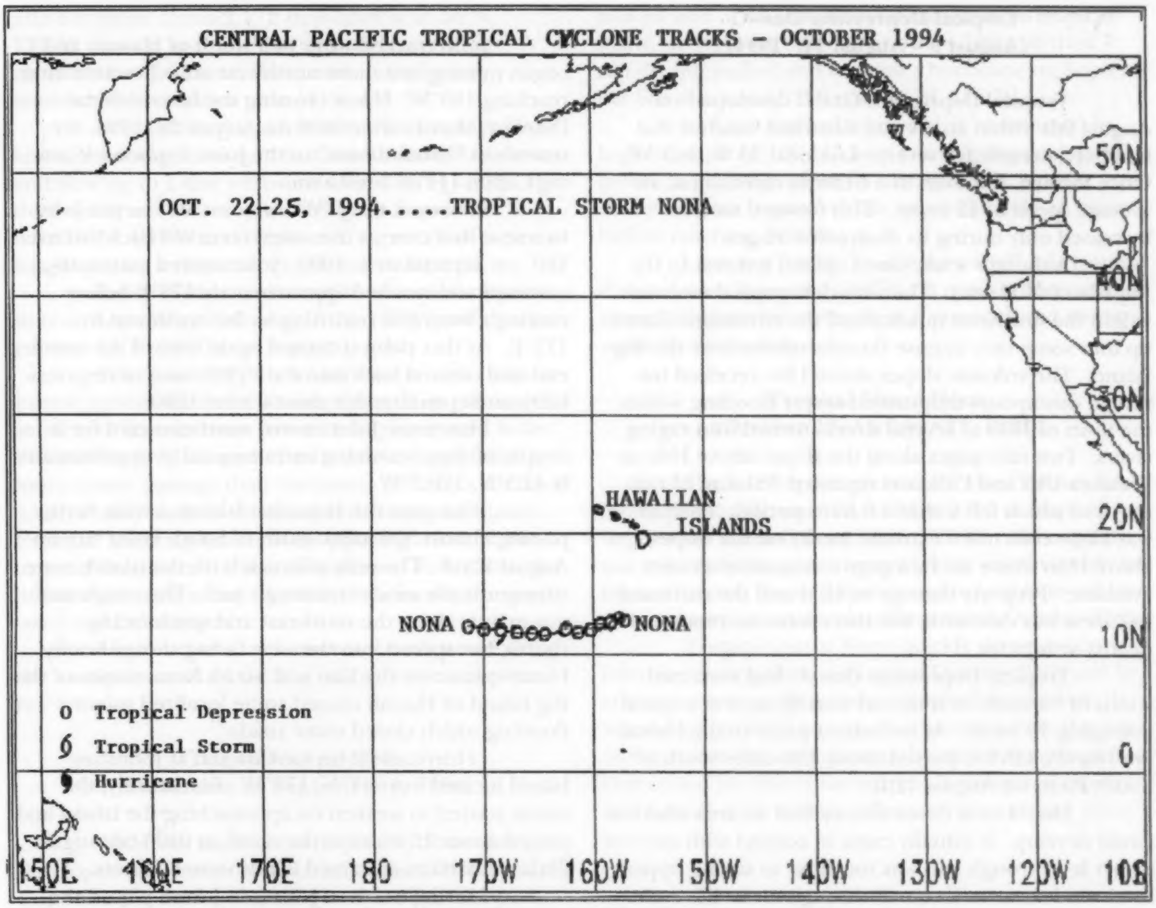
(CPHC) area on July 24.

Gilma maintained its maximum winds close to 140 knots through 0600 on July 25th and then began to decrease in intensity as it crossed 146°W. It continued to move along a rather straight path westward along latitude 12°N until reaching 160°W. It then made a slight northwestward turn. The CPHC tracked Gilma on its westward course far to the south of the Hawaiian Islands as it continued to lose strength. Gilma was downgraded to a tropical storm while passing some 400 miles south of South Point on the Big Island at 0000 on July 27. It remained a tropical storm as it turned northwest at 1800 on July 29 near 15°N 173°W. Gilma was downgraded to a tropical depression at 1800 on July 30 near 18°N, 176°W and was dropped after 0000 on July 31.

Hurricane Gilma, at its closest approach to the Hawaiian Islands, was about 510 miles south of South Point on the Big Island of Hawaii around noon on July 26, 1994, with maximum sustained winds of about 70 knots.

It continued to move westward from this position until it neared 160°W with the winds steadily decreasing to below hurricane force by 0000 on July 27, 1994. The maximum sustained winds were down to 50 knots before Gilma reached 160°W.

After passing 160°W, Gilma continued to slowly lose energy as it moved toward the west northwest, but remained a tropical storm as it passed some 200 miles south of Johnston Island shortly after 0000 on July 29th. Gilma's winds finally dropped below tropical storm force at 1800 on July 30th. It was dropped as a tropical depression at 0000 July 31, 1994 when it was near 19°N, 176°W.



A close view of tracks of tropical cyclones that either formed in or entered the Central North Pacific in October 1994

Hurricane Li
(August 3 - August 12, 1994)

Li was initially recognized as a tropical disturbance near 11°N, 120°W on July 30th. It moved west and strengthened into a tropical depression near 12°N, 138°W on August 2nd, and the Central Pacific Hurricane Center began issuing advisories a day later.

Li remained a depression and appeared to be weakening as it moved south of the Hawaiian Islands on August 6th. However, the system regenerated on August 7th and became Tropical Storm Li near 14°N, 165°W on August 8th.

Li became the first storm named in the Central Pacific during the 1994 season. Li continued to move west and passed about 180 miles south of Johnston Island on August 9th. On August 11th, the storm curved slightly southwestward and further intensified before becoming a hurricane on August 12th when it was within 120 miles of the International Dateline. Afterwards, Li weakened and moved west northwestward in the general direction of Wake Island.

The storm remained a tropical depression far enough south to be influenced by the Intertropical Convergence Zone. However, upper level divergence was weak enough to retard any intensification. By August 5, the system was nearly void of deep convection and advisories were discontinued. However, convection began to increase a day later and the system continued to reintensify and become Tropical Storm Li on August 8. It passed about 180 miles south of Johnston Island on August 9. The atoll had little effect either on winds or waves. Just before crossing the International Dateline on August 12, the storm intensified and became Hurricane Li. Afterward, it weakened and moved in the general direction of Wake Island where there were some showers and light winds.

Tropical Depression One–C
(August 9 – August 14, 1994)

Tropical Depression One-C developed on August 9th within an area of disturbed weather that had been present for several days near 15°N, 145°W. Once formed, it moved in a westerly direction at an average speed of 12 knots. This forward motion increased only during its dissipation stages.

Although weak, One-C posed a threat to the Big Island of Hawaii. The very rich tropical moisture within the northeast quadrant of the circulation flared up into some very intense thunderstorms over the Big Island. The volcanic slopes above Hilo received torrential downpours that caused severe flooding within the town of Hilo as several streets turned into raging rivers. Two rain gages along the slopes above Hilo at Waiakea Uka and Piihonua reported 381 mm of rain much of which fell within a 6 hour period. Rainfall was likely even more extreme locally on the slopes above Hilo where no rain gage measurements were available. Property damage to Hilo and the surrounding areas was extensive, but there were no reports of deaths or injuries.

Tropical Depression One–C had sustained winds of 30 knots as it moved steadily west at a speed averaging 10 knots. At its nearest point to the Hawaiian Islands, ONE-C passed about 100 miles south of South Point on August 12th.

One–C was never able to find an area where it could develop. It initially came in contact with an upper level trough and was too close to strong upper level wind shear to its north throughout its life cycle. In addition, its track took it across sea surface temperatures that were marginal for development.

Hurricane John
(August 20 – August 28, 1994)
(September 8 – September 10, 1994)

Hurricane John was 10 days old and a well developed hurricane with 100 knot winds when it entered the Central North Pacific from the eastern Pacific on August 20th. John moved westward along 15°N at a steady 12-15 knots, dipping south slightly to 14°N on August 22nd and 23rd. The storm continued to gain strength as it approached the longitude of the Hawaiian Islands.

Upon crossing 155°W, sustained winds based on Dvorak intensity analysis were estimated slightly above 150 knots, making John the most intense hurricane of record in the Central Pacific. Even Emilia and Gilma which had tracked south of Hawaii earlier in the season were not as intense, as their strongest winds were only estimated at 140 knots at their peak.

John tracked west, well south of Hawaii, and began moving in a more northwest only direction after reaching 160°W. Upon crossing the International Dateline, shortly after 0600 on August 28, 1994, the storm was "handed over" to the Joint Typhoon Warning Center (JTWC) in Guam.

However, the JTWC was not able to put John to rest at that time as the storm recurved back toward 180° on September 1, 1994. John moved eastsoutheastward and reached approximately 179°E before making a loop and returning to the northwest to 175°E. At that point it turned again toward the northeast and crossed back into the CPHC area of responsibility on September 8th shortly after 1200.

Hurricane John moved northeastward for a couple of days becoming extra-tropical at approximately 42.5°N, 170.3°W.

John gave the Hawaiian Islands a wide berth, passing almost 300 miles south of South Point late on August 22nd. The only effects felt on the islands were stronger trade winds and rough surf. The rough surf was mainly along the southeast and south facing shores, but spread into the west facing shores briefly. Heavy rains over the Kau and South Kona slopes of the Big Island of Hawaii caused some localized minor flooding which closed some roads.

Hurricane John took its aim at Johnston Island located near 17°N, 170°W. Fortunately, the storm started to weaken on approaching the island and passed about 15 miles to the north at 0400 on August 26th. Maximum sustained winds were 80 knots.

Moving north of Johnston Island placed the islet in the benign semicircle of the tropical cyclone. The 1100 people on Johnston Island had been evacuated to Honolulu as a precautionary measure. A remote readout anemometer on the ATOLL reported sustained winds between 40-50 knots for about 6 hours with gusts as high as 67 knots. Damage to Johnston Island was estimate at $15 million.

This was not the first time a tropical cyclone reentered the Central Pacific from the western Pacific. Other recorded events include:

- Tropical Storm Carmen.– entered the Central Pacific from the southwest on April 7, 1980 and became a depression the following day.
- Tropical Storm Skip – moved into the Central Pacific from the southwest on September 7, 1985 and became extratropical the following day.

Hurricane Kristy
(August 31 - September 4, 1994)

Kristy was initially recognized as a disturbance near 13°N 117°W on August 27th. It strengthened

into a tropical storm 2 1/2 days later near 16°N, 133°W moving just north of west with an average movement of 16 knots. Hurricane intensity was reached 30 hours later near 16°N, 141°W.

Kristy existed as a hurricane for another 30 hours, reaching maximum sustained winds of 90 knots and slowing to a due westward course at 14 knots. It then weakened to a tropical storm on September 1 near 16°N, 150°W and began moving south of west no longer posing a threat to the Hawaiian Islands.

Kristy further weakened to a tropical depression on September 3rd near 15°N, 160°W and dissipated near 15°N, 164°W on September 4th.

Kristy was a tightly wound storm with thunderstorms mostly within a 60 mile radius of its relatively small eye. Its minimum pressure was estimated to be 970 millibars. Most numerical models suggested a much closer passage than the actual 290 miles south of South Point; some even taking it through the islands. Eventual shearing action with opposing winds at the top and bottom of the storm weakened Kristy with the bottom layers dictating its return to a mostly due westward and faraway path.

High surf of 2 to 3 meters was observed along the southeast coast of the Big Island only on September 2.

Tropical Storm Mele
(September 6 - September 9, 1994)

Mele was the second tropical cyclone that developed within the boundaries of the CPHC area of responsibility during the 1994 season. It developed rapidly overnight and at 2100 on September 6th, it became tropical depression TWO-C. At that time it was located approximately 800 miles south southwest of Lihue, Kauai.

By 0300 on September 7th, the system was upgraded to Tropical Storm status as it continued to intensify in a favorable warm sea surface temperature area. The following day, however, Mele lost all of its energy and began to dissipate.

Tropical Storm Mele developed in an area well south of any land mass and was never a threat to any of the islands of the Pacific. It was initially in a favorable area, as warm sea surface temperatures and an upper level anticyclone existed.

The last advisory was issued on September 9, 1994 at 1500.

Tropical Depression Lane
(September 9 - September 10, 1994)

Lane developed as a tropical depression on September 3, 1994 at 0000 near 17°N, 105°W. It moved west at 10-15 knots and increased to tropical storm strength on September 4th at 1200. It then rapidly intensified and became a hurricane on September 5th at around 1800 near 18°N, 118°W.

As Lane tracked westward, it maintained its highest winds of 100-115 knots during September 6-7, before beginning to lose its strength. The system decreased to a tropical storm approximately 18 hours before reaching 140°W.

Lane was unable to maintain itself as a tropical cyclone once it crossed 140°W. It quickly decreased to tropical depression strength as it encountered strong westerly winds aloft.

Tropical Storm Nona
(October 22 - October 25, 1994)

The last tropical cyclone for the 1994 season developed on October 22, 1994 at 2100 as tropical depression Three-C near 13°N, 157°W. Although it was initially in an environment which was favorable for intensification, the depression was only able to achieve minimal tropical storm classification on October 25th.

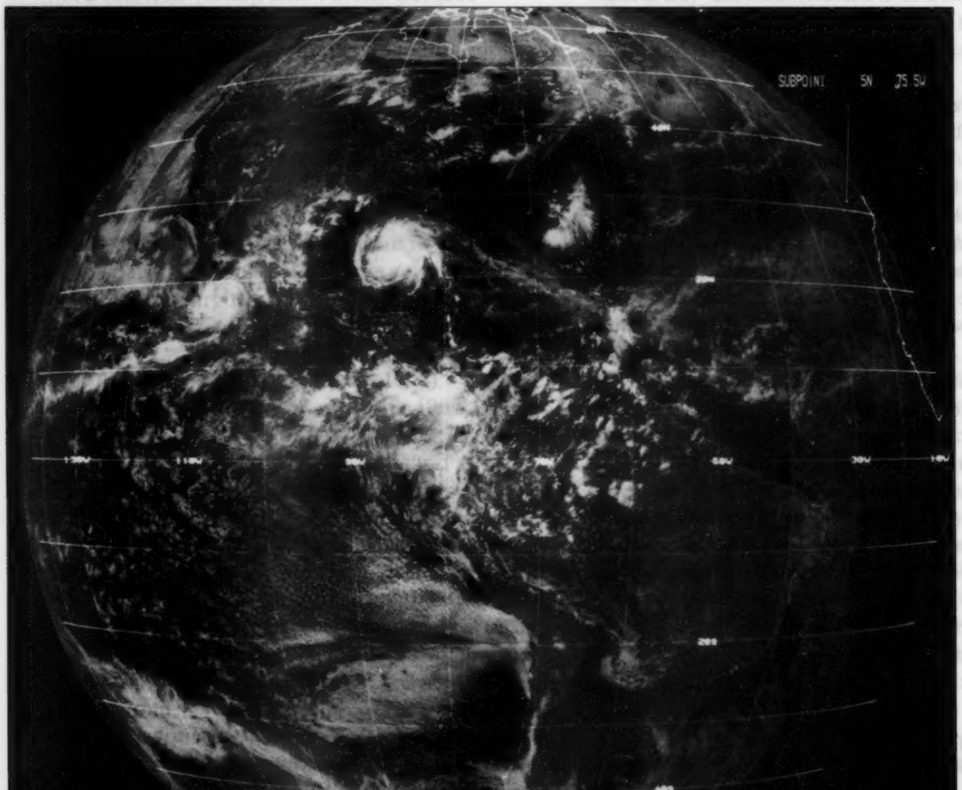
Tropical storm Nona quickly decreased in intensity during the morning on October 25th and by afternoon was again merely a tropical depression. It was the upper level trough that moved across the top of the storm that contributed the major shearing effect that ended the life of the storm. It dissipated rapidly and lost all of its cyclonic characteristics by late afternoon.

Glenn H. Trapp is the Director of the Central Pacific Hurricane Center (CPHC) and Area Manager/Meteorologist-In-Charge (AM/MIC) of the Weather Service Forecast Office (WSFO) in Honolulu, Hawaii. Ben Hablutzel is the Deputy Director of the CPHC and Deputy MIC of WSFO Honolulu, Hawaii. Armando L. Garza is the Science & Operations Officer at WSFO Honolulu and serves as a hurricane specialist during the hurricane season. Also contributing to this report were fellow lead forecasters (hurricane specialists) Hans Rosendahl, Robert Farrell, Roy Matsuda, Richard Sasaki, and Tim Craig. Providing satellite support and archiving of NOAA-11 photographs was Daniel Eum - PRC contractor.

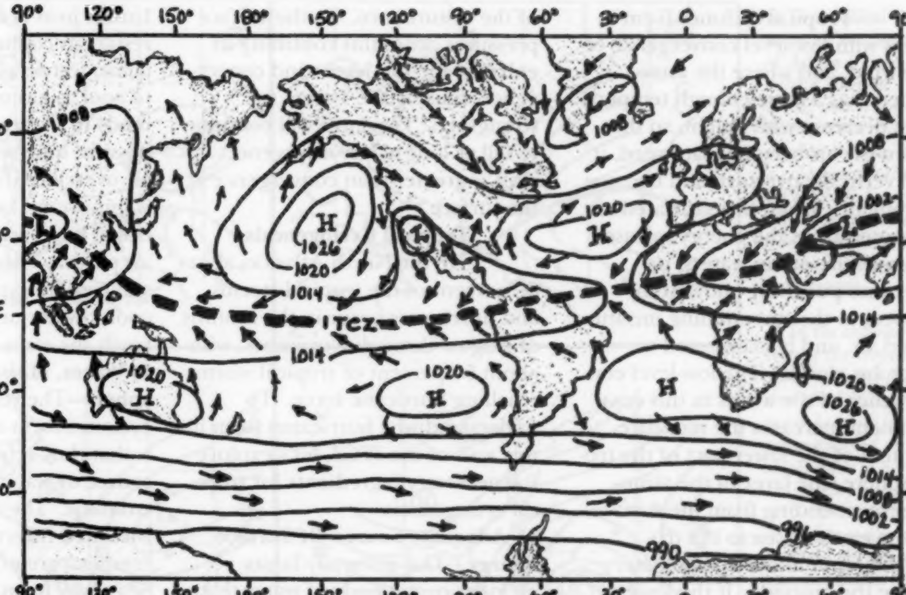
The Intertropical Convergence Zone—Birthplace of Hurricanes

Debi Iacovelli
Cape Coral, Florida

Through the months of June to November, the water temperature rises to about 80° F in a windless area near the equator between the coast of Africa and the United States. This area, known as the Intertropical Convergence Zone (ITCZ) is approximately 50 to 100 miles wide, along which some 100 tropical disturbances will form each Atlantic hurricane season. Of these 100 disturbances, about 10 will grow to become a named storm with an average of six developing into hurricanes. In the months of August and September, the lifespan of a hurricane is about 2 weeks. Hurricanes that form in June, July, October and November generally last about seven days due to the shorter distance they travel before hitting land. Only two or three of the six hurricanes that develop each season may strike the mainland of North America.



This visible, full-disk image from the East Coast GOES (Geostationary Operational Environmental Satellite) operated by the National Oceanic and Atmospheric Administration (NOAA) shows two hurricanes bearing down on the North American continent. On the day, August 7, 1980, Hurricane Allen is entering the Gulf of Mexico on a straight line to the Texas coast, while Hurricane Howard is in the Pacific Ocean south of Baha California.



Average July sea-level pressure distribution and surface wind-flow patterns. The heavy dashed line represents the position of the ITCZ.

Tropical cyclones are set on their course by tradewinds flowing along the southern edge of a high pressure system located over the Island of Bermuda during the summer months. This high pressure system is referred to as the "Bermuda High," a warm, humid air mass that extends up to eight miles into the atmosphere. The Bermuda High controls the weather in the North Atlantic during the hurricane season.

Although the term "Intertropical Convergence Zone" (ITCZ) is widely used to define the area near the equator where the prevailing trade wind systems of the Northern and Southern Hemisphere meet and converge, the term has been somewhat corrupted. In addition to being referred to as the ITCZ, this extensive, low-latitude pressure trough has often been referred to anything from an "equatorial trough," "monsoon trough," "heat trough," "intertropical front" and "trough axis," to an "axis of maximum cloudiness." Probably the most correct term would be "near-equatorial convergence zone," but for the sake of familiarity, this area will be called the ITCZ for our discussion.

The ITCZ is a persistent zone of unsettled weather circling the globe that shifts along with the position of the sun. It is located between 5°N and 10°N from the months of April to September. In this area near the equator, surface pressure gradients are directed from east to west, ensuring that the northeast and southeast trade winds converge. When we examine the ITCZ, we find that we have all the ingredients necessary for tropical cyclogenesis (cyclone development).

In the developing hurricane, tradewinds along the ITCZ determine its movement. These prevailing surface winds move small, low pressure atmospheric disturbances westward as they parallel the equator. Here the disturbances begin to feel the effects of the rotating earth and start to move counterclockwise. A hurricane is like a simple heat engine. Warm, moisture-laden air that has been heated by the sun rises from the water's surface. Given a twist by the rotation of the earth, more humid air is sucked into the warm core of the storm's center and fuels the storm. As the air ascends, it expands in the reduced pressure of the upper atmosphere and cools. Moisture in this air is condensed, which releases heat energy to the surrounding atmosphere of the storm core, thus regenerating the heat cycle and causing the storm to intensify. As the storm rotates, spiral rainbands rise to about 12 kms, releasing torrential rains where it merges with high altitude air currents. The cooler atmosphere mixing with the warm, rising air causes it to become dry and sink, resulting in lower pressures in the center of the storm. This difference in atmospheric pressures create a calm, nearly cloud-free area called the "eye" of the storm.

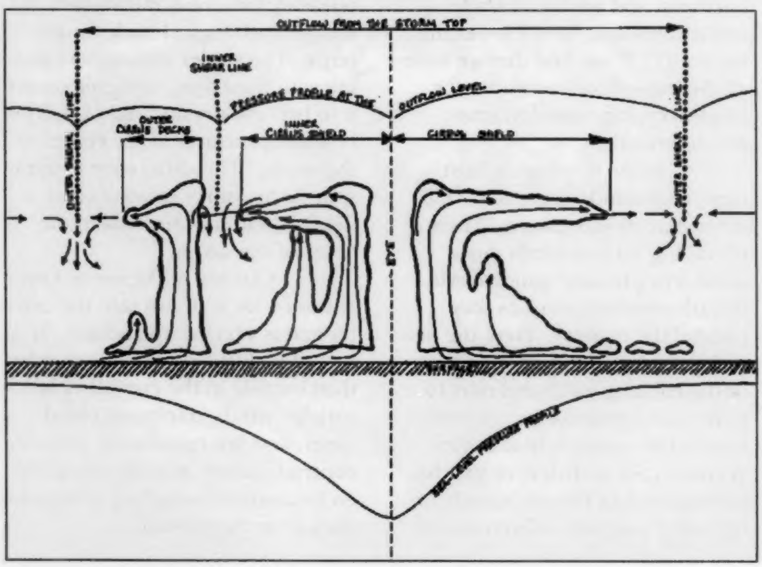
Outside of the eye at lower altitudes, air is drawn into the center and is whirled up and out. Dramatically different conditions exist then outside in the eyewall. Light, variable winds, minimum cloud cover, and low barometric pressure contrast sharply with the wind-driven rains often exceeding 100 knots, outside in the eyewall.

Tropical cyclones form in areas with low-level convergence of the wind, and where the atmosphere has a large enough temperature decrease with height, so that when the air becomes saturated, it will vertically overturn and become turbulent. When this saturated air is heated from the energy released from warm, ocean waters, it becomes positively buoyant in respect to the surrounding unsaturated air, and is manifested as cumulus clouds. The low-level convergence of the winds in this environment increases the moisture content of the lower part of the troposphere (the layer of the atmosphere extending from the surface of the earth or sea to the tropospause, or about 10 kilometers above the ground). If the lower and middle troposphere are sufficiently moist, then the influx of the surrounding air will continue to fuel the cumulus clouds, thus allowing them to grow to the top of the troposphere. Since the stratosphere (which is above the troposphere and below the mesosphere) has strong, thermodynamic stability, as the cumulus clouds transport heat and moisture upwards, they start to spread out horizontally, which lowers the surface pressure of the disturbance. As the surface pressures drop, this continues to enhance the low-level wind convergence, causing the system to strengthen. Pressures will continue to fall as long as the divergence aloft is greater than convergence at the surface.

Tropical Cyclogenesis

In the North Atlantic, about 80 percent of the tropical storms and hurricanes occur in the months of August through November, with about 55 percent of tropical storms reaching hurricane force. To understand why hurricanes form in this area of the ITCZ, let's explore the necessary ingredients for tropical cyclogenesis:

1) Adequate Source Of Surface Energy –This generally limits cyclones over a body of water that has a surface temperature of at least 79°F (or 26°C). Theories are proposed that this warm water should be at least 61 meters deep, so when it is moved by high winds, the sea surface temperature will not be too cold for cyclogenesis. The hurricane is a direct thermal heat engine, requiring that the warmest temperatures be at its center. However, as air spirals into a hurricane, it expands as a result of lower pressures closer to the eye.



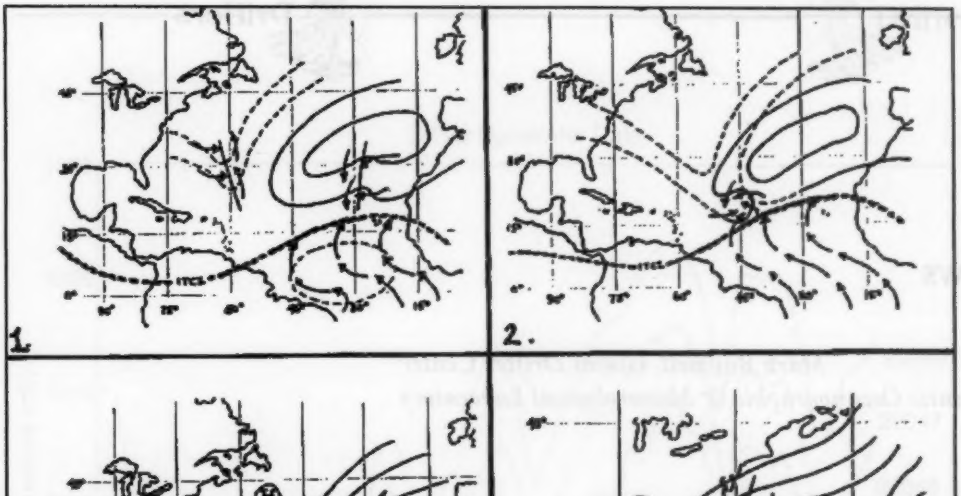
Unless heat is added, this expansion results in cooling. Over warm ocean water, as an air parcel starts to cool as a result of expansion, it tends to overturn because of the positive buoyancy created as cooler air overrides the warm sea water. It is important, however, that the ocean be as warm as the incoming air parcel. Otherwise, the air will still cool by expansion over the cooler water until the air and water reach the same temperature.

2) Warm, Moist Tropical Atmosphere–The reason that tropical cyclones form over oceanic regions is that they require an unlimited source of water to fuel the deep cumulus. The rate of evaporation is related directly to the surface temperature of the body of water. Sea spray from the strong winds are a contributing ingredient to the storm environment, as well as moist air parcles transported into the storm from the surrounding air.

3) Wind Shear–The hurricane is a column of rapidly rising air that produces an intense low pressure area near the storm center. So, weak vertical shear of the horizontal winds (less than 15 knots) is very important. This allows the main areas of convection to remain over the center of lowest pressure in the hurricane, fueling intensification.

4) Pre-existing Disturbances–There are different types of weather disturbances that can be found along the ITCZ in the North Atlantic. Some of them are as follows:

Many waves in the low-level easterlies stem from cold-lows (upper-level cyclones). This disturbance appears on weather maps as a northward bulge in the isobars. On the western side of the wave where surface winds diverge, sinking air generally produces fair weather. On the eastern side where the winds converge, this rising air triggers heavy rainfall and thunderstorms. This is the side that generates tropical storms and hurricanes.



1: The tropical wave off the coast of Africa is interacting with the ITCZ and a linear disturbance called a polar trough, or a cold front stalled off the U.S. coast. This scenario usually occurs early or late in the hurricane season.

2: In the interaction of the tropical wave with the front and the ITCZ, the wave becomes better organized and shows signs of vertical development.

3: System is now a tropical storm with closed isobars, being steered toward the U.S.

4: The system is now a hurricane.

Vortexes or an area of cyclonic cloud spin and circulation patterns can easily be detected in satellite pictures. While many evolve into tropical cyclones, they differ from them because their environment is strongly baroclinic (contour lines cross isotherms, with an easterly sheer), as opposed to tropical cyclones which have a barotropic environment (contour lines parallel isotherms and a uniform rain distribution). Vortexes are most intense near the surface rather than aloft.

Linear Disturbances is defined as a synoptic system that includes squall lines, surface cold fronts, shear lines, surges and the ITCZ itself. This system has its vorticity (a measure of the spin of small air parcles) or divergence concentrated in a zone that is longer than it is wide. Many times we see a tropical disturbance forming at the tail end of a stalled cold front (a linear disturbance), especially early or late in the Atlantic Season in the Gulf of Mexico.

5) Earth's Rotation–The tropical cyclone also needs to be more than 4 to 5 degrees of latitude removed from the equator so that the air will tend to spiral inward cyclonically at lower levels and outwardly anticyclonic at the upper levels due to the Coriolis force.

6) Upper-Tropospheric Outflow–A large-scale high pressure system in the upper-troposphere is important to evacuate mass from the region of the cyclone. Divergent, upper-level winds are critical for removing the mass far from the storm environment, allowing intensification. When the inward flow accelerates and minimal hurricane-force winds are achieved, air parcels can no longer reach the center of the cyclone because of centrifugal force. This causes them to blow tangent to lines of constant pressure some distance from the center, forming the eyewall of a hurricane. For the tropical cyclone to continue to be maintained, it needs to stay over the warm, moist waters, have warm parcels of air transported into it and have an upper level anticyclone aloft to remove the outflow.

As tropical cyclones move out over the cold Atlantic Ocean, they lose the rich source of energy needed to fuel them. Many times tropical cyclones become extratropical at the higher latitudes, or even combine with existing temperate zone disturbances or frontal troughs moving northward and bring wet, squally weather to England.

*Debi Iacovelli is a writer specializing in tropical meteorology. She is also the associate editor of the **Weather Watcher Review**, the official publication of the International Weather Watchers.*

Drifter News

Mark Bushnell, Global Drifter Center
NOAA Atlantic Oceanographic & Meteorological Laboratory

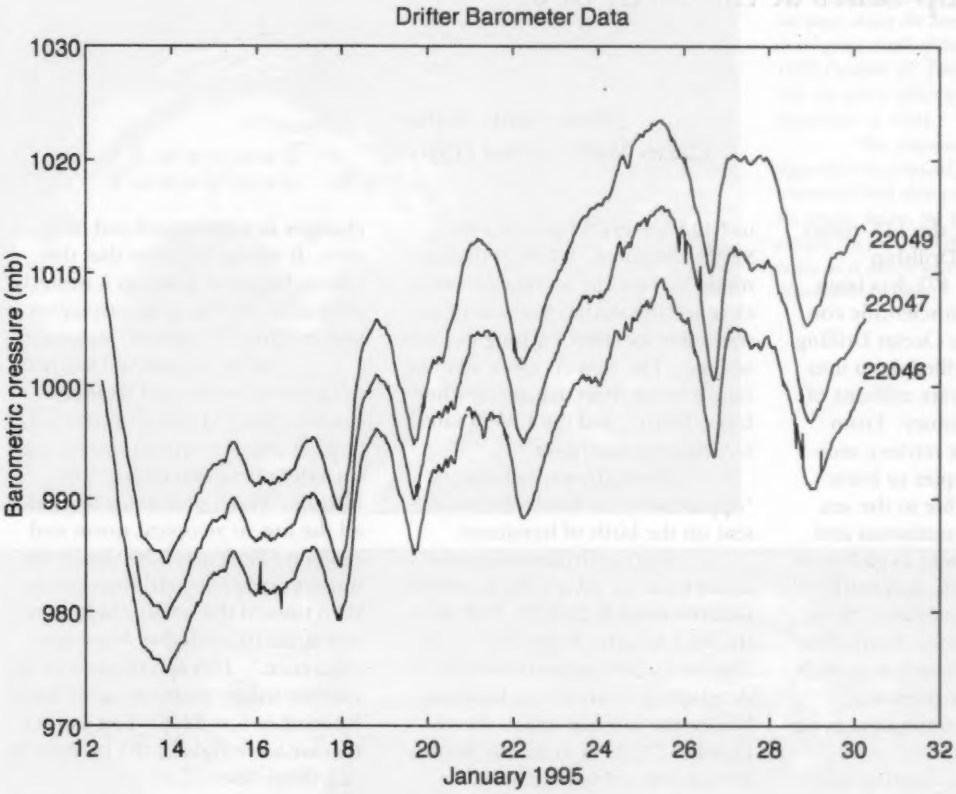
The Surface Velocity Program (SVP) drifters are small, easily deployed, satellite-tracked instruments. They routinely provide information on ocean currents, sea surface temperature and now barometric pressure. The new array of drifters being deployed by the Global Drifter Center (GDC) in the Indian Ocean and Southern Ocean is beginning to take form. Volunteers Observing Ships (VOS) research vessels, and planes have been used during the past months to begin the initial seeding of these basins. Drifters are being placed at a rate of roughly one per day, and that pace is expected to increase soon as several large deployments begin.

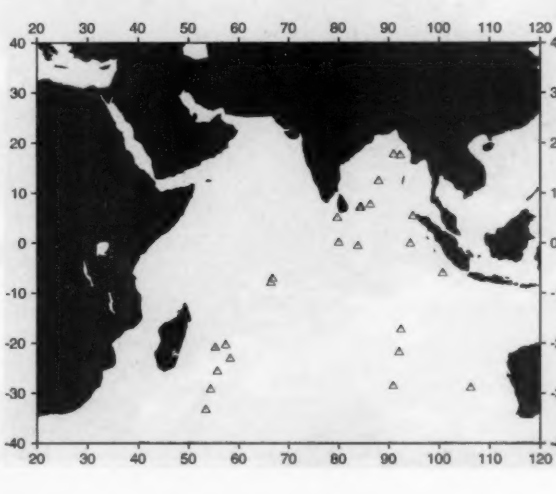
In the Indian Ocean 24 drifters have been deployed as of mid March. Their locations on March 13 are shown on page 31. Fifty-six more are aboard ships and on the way to be placed in the next few months. The VOS ships ***Nedlloyd Van Neck, Nedlloyd Van Diemen***, and ***Nedlloyd Van Noort*** have assisted with these deployments. Many oceanographic research field programs have focused on the Indian Ocean in 1995, creating both the need for drifter data and an excellent opportunity for deployment. The research vessels ***Knorr*** and ***Malcolm Baldrige*** will handle many of the drifters scheduled for deployment in the near future. In the long run, however, VOS companies such as the American President line and associated feeder vessels will be relied upon to maintain the Indian Ocean array.

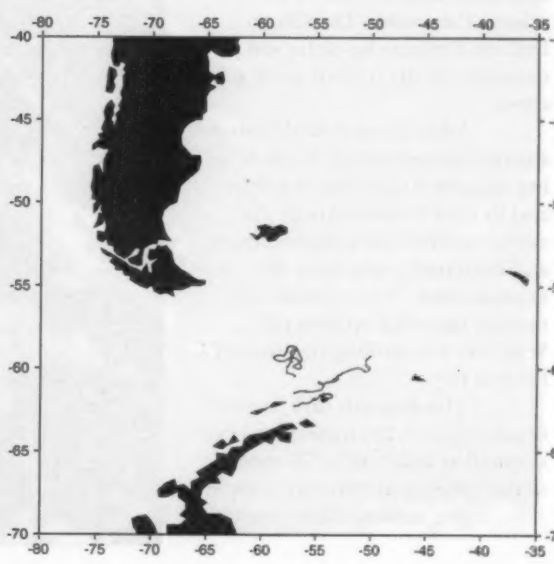
In the Southern Ocean, 37 drifters are presently operating between latitudes 30°S and 60°S as of mid March. The research vessels ***Surveyor, Marion Dufresne, Melville***, and U.S. Navy aircraft have been used to establish this array. Thirty-two of these are barometer drifters that store and forward hourly atmospheric pressure. Eight more barometer drifters are aboard ships and will be deployed soon. Navy aircraft placed 19 more barometer drifters in the Southern Ocean between longitudes 055°E and 115°E in late March.

Three barometer drifters placed in the Southern Ocean's notorious Drake passage by the ***Surveyor*** are particularly interesting. These three were placed closer together than initially planned in an effort to cooperate with a research program examining krill populations, among other things. The hope was that they would quickly disperse to the desired 500 kilometer spacing in this energetic area. The trajectory of these drifters of these drifters for the period January 20- March. 13 is seen on page 31. Surprisingly, rather than drifting apart two of the three meandered in place, creating a good chance to compare these new barometer sensor records. A pórtion of the hourly barometer readings transmitted from these drifters is also shown on the next page. The traces have been offset by 5 millibars for clarity. It's clear the records agree well, and based on rapid barometric changes observed and the severe weather implied, this is a good use of unmanned instrumentation.

Look for a discussion of the types of sensors found aboard SVP drifters in the next issue of *Mariners Weather Log*. Anyone interested in helping SVP deployments or desiring additional drifter information should contact their Port Meteorological Officer, SEAS Representative or Mark Bushnell at the GDC, NOAA/AOML, 4301 Rickenbacker Causeway, Miami, Florida 33149. Phone (301) 361-4353, fax (305) 361-4582, Internet Bushnell@aoml.erl.gov or telex 6507457601.







At left is a portion of the barometric records from the same three drifters launched in the Drake Passage. The record of drifter 22047 is offset by 5 millibars and 22046 is offset 10 millibars.

Below left, triangles show the mid March locations of 24 SVP drifters deployed in the Indian Ocean by the Knorr and several Nedlloyd ships.

Below right, three barometer drifter trajectories deployed by the Surveyor in the Drake Passage for the period January 20 through March 13.

The Drillship *Sedco* at the birth of a Hurricane

Edwin Oonk, Master
Clarie Watt, Second Officer

Since 1985, the 143-meter Scientific Drillship *Sedco*/BP 471, has been involved in scientific coring for the Ocean Drilling Program. Holes drilled deep into the sea floor penetrate millions of years of geologic history. From these holes scientist retrieve sediment and rock samples to learn about evolution of life in the sea, rearrangement of continents and changes through times in global climate, ocean currents, and worldwide sea levels. In addition, these cores allow scientists to learn more about powerful natural forces such as volcanoes and earthquakes, which have direct consequences on humankind.

This unique floating laboratory was built in Halifax, Nova Scotia in 1978 and today provides invaluable resources for scientists around the world. The Ocean Drilling Program has achieved preeminence in the field of earth sciences.

With Texas A & M University in College Station, Texas serving as science operator, the ship and its crew travels all over the earth's oceans collecting sediment and hard rock cores from the oceanic crust. The rotation is 2 months on and 2 months off. While on site, drilling continues 24 hours a day.

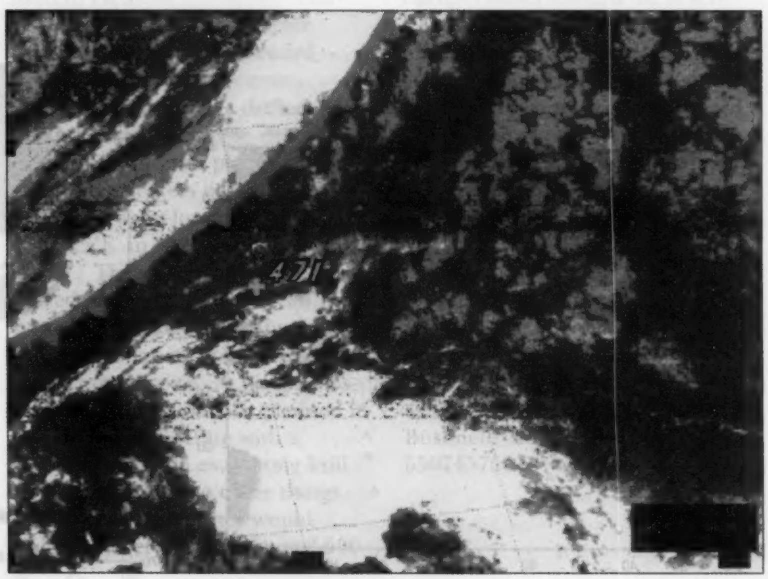
The ship can drill in water depths up to 8,200 meters and can suspend as much as 9,150 meters of drill pipe to obtain core samples

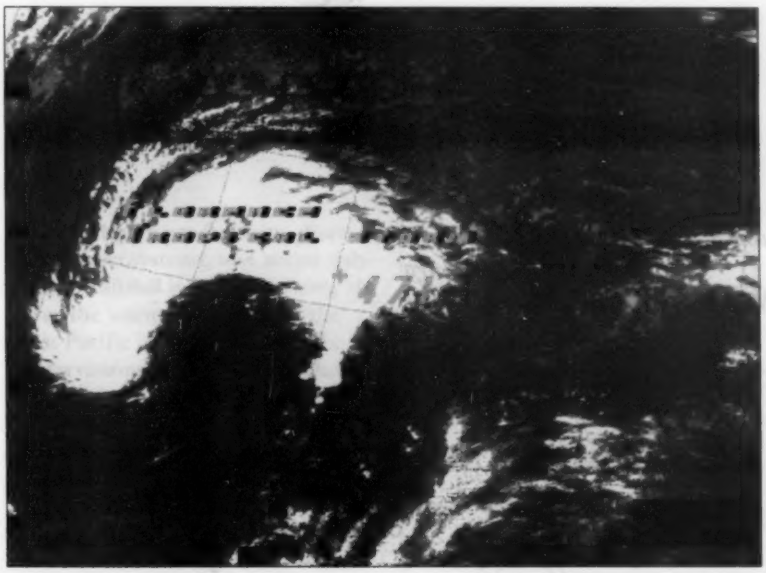
We send weather reports to NOAA every 6 hours via the SEAS computer. While in drilling mode we become a valuable weather reporting station because of our stationary location for long periods of time. The ship receives weather information from marine weather faxes, Navtex and the LAWS satellite imagery computer.

Recently, we had the "opportunity" to have a front row seat on the birth of hurricane.

During drilling operations at the location TAG (Trans Atlantic Geo-traverse) at 26.1°N, 44.8°W in the Mid Atlantic Ridge, we observed a low pressure system developing south of our location. Notice the satellite image dated October 30, 1994 at 10:20. As this system crossed our location, we experienced heavy rain and erratic changes in wind speed and direction. It was at this time that the system began to move in a westerly direction. We became suspicious and watched this system seriously.

As the low moved further to the west we noticed from the satellite image dated November 2, at 2151 that the system was taking on a definite spiral effect. The National Weather Service upgraded the low to atropical storm and called it "Florence." As the storm moved farther toward the west and then toward the north, the system was again upgraded to hurricane "Florence." This can be seen in the satellite image (bottom right) dated November 6 at 2205. You can see that we were right at the birthplace of a hurricane.





The NOAA satellite image on the previous page shows the low pressure system developing south of the Sedco's position at 1002 October 30, 1994. In the image at left, the spiral effect is visible at 2151 November 2, 1994.

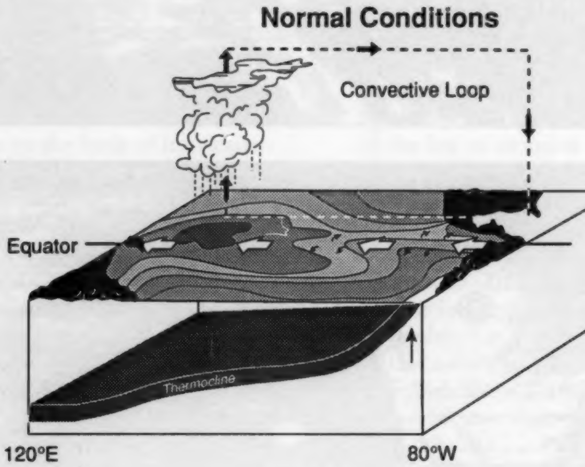
The National Weather Services upgrades the tropical storm as it moves westward and then toward the north. In the image below, the Drillship Sedco escapes the full fury of Hurricane Florence as it moves westward at 2205 on November 6, 1994.

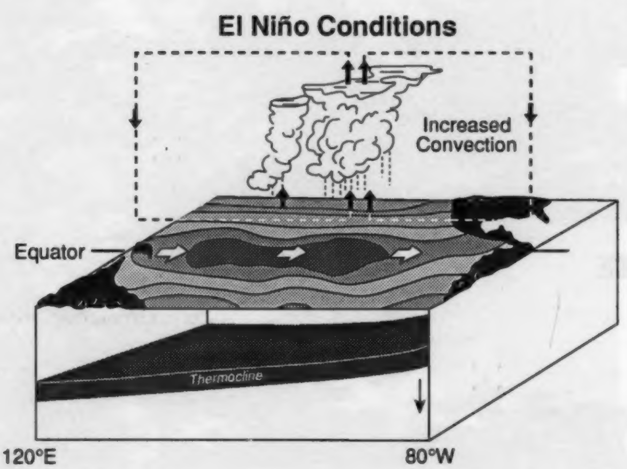
What is an El Niño?

Michael J. McPhaden, William S. Kessler, Nancy N. Soreide,
Dai C. McClurg
NOAA/PMEL TOGA-TAO Project Office
Seattle, Washington

El Niño is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around for the globe. Among these consequences are increased rainfall across the southern tier of the U.S. and in Peru, which has caused destructive flooding, and drought in the west Pacific, sometimes associated with devastating brush fires in Australia. Observations of conditions in the tropical Pacific are considered essential for the prediction of short term (up to 1 year) climate variations. To provide necessary data, NOAA operates a network of buoys which measure temperature, currents, and winds in the equatorial band. These buoys daily transmit data which are available to researchers and forecasters around the world in real time.

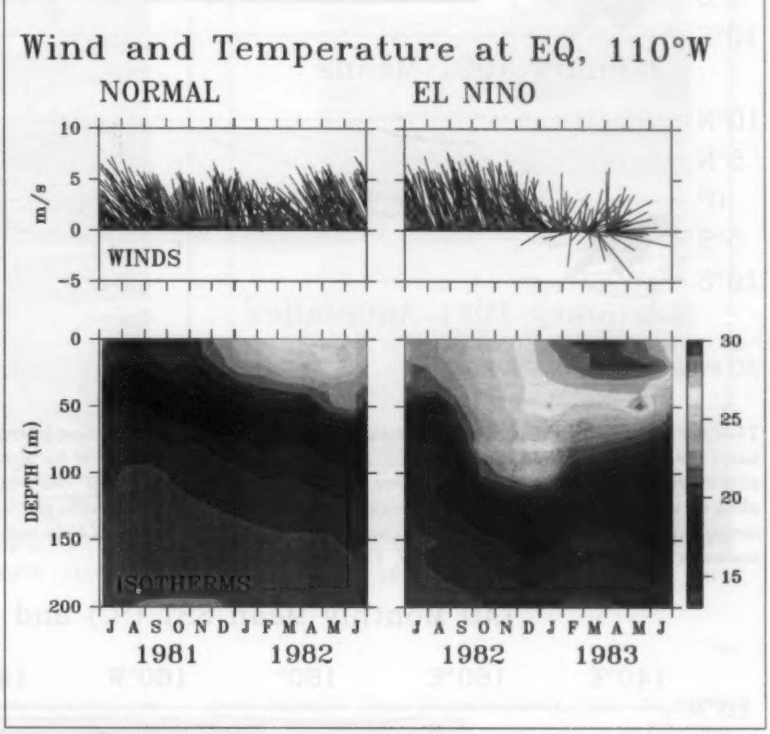
In normal, non-El Niño conditions (right), the trade winds blow toward the west across the tropical Pacific. These winds pile up warm surface water in the west Pacific, so that the sea surface is about 1/2 meter higher at Indonesia than at Ecuador. The sea surface temperature is about 8° C higher in the west, with cool temperatures off South America, due to an upwelling of cold water from deeper levels. This cold water is nutrient-rich, supporting high lev-





els of primary productivity, diverse marine ecosystems, and major fisheries. Rainfall is found in rising air over the warmest water, and the east Pacific is relatively dry. The observations at 110°W (left) show that the cool water below about 17°C (the black band in these plots) is within 50 meters of the surface.

During El Niño, the trade winds relax in the central and western Pacific leading to a depression of the thermocline in the eastern Pacific, and an elevation of the thermocline in the west. The observations at 110°W show, for example, that during 1982-1983, the 17°-C isotherm dropped to about 150 meters depth. This reduced the efficiency of the upwelling to cool the surface and cut off the supply of nutrient rich thermocline water to the euphotic zone. The result was a rise in sea surface temperature and a drastic decline in primary productivity, the latter of which adversely affected higher trophic levels of the food chain, including commercial fisheries in this region. The weakening of easterly tradewinds during El Niño is evident in this diagram as well. Rainfall follows the warm water eastward, displacement of the atmospheric heat source overlaying the warmest water result in large changes in the global atmospheric circulation, which in turn force changes in weather in regions far removed from the tropical Pacific.

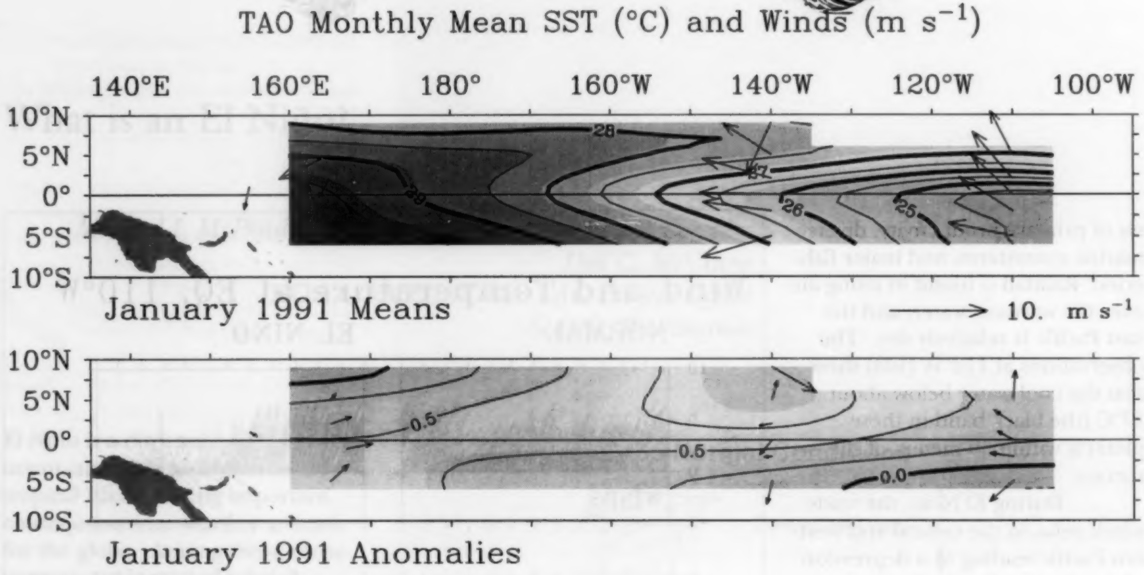


Plot of wind and temperature conditions during normal and El Niño years at the equator along the 110°W meridian. Note the cool water (black band) is within 50 meters of the surface during a normal year.

El Niño can be seen in measurements of the sea surface temperature, such as those seen on page 36, which were made from the TAO array of moored Atlas buoys and Proteus buoys.

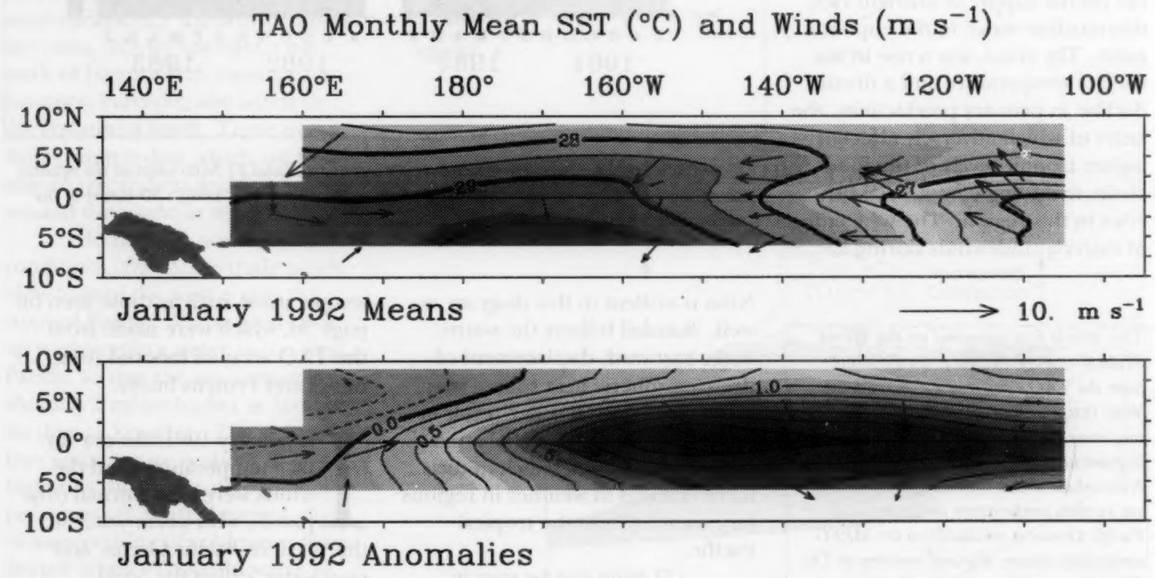
In January 1991, the sea surface temperatures and the winds were near normal (top panel), with warm water in the Western Pacific Ocean, and cool water, called the "cold tongue," in the Eastern Pacific

This article first appeared on the World Wide Web page "What is an El Nino? from the TAO Project at NOAA/PMEL Web: (http://www.pmel.noaa.gov/toga-tao/home.html or Internet: taogroup @pmel.noaa.gov. An animation of El Nino which shows the changes in monthly sea surface temperature in the tropical Pacific Ocean is available on an MPEG animation viewer. Figures courtesy of The TAO Project Office, Seattle, Washington.

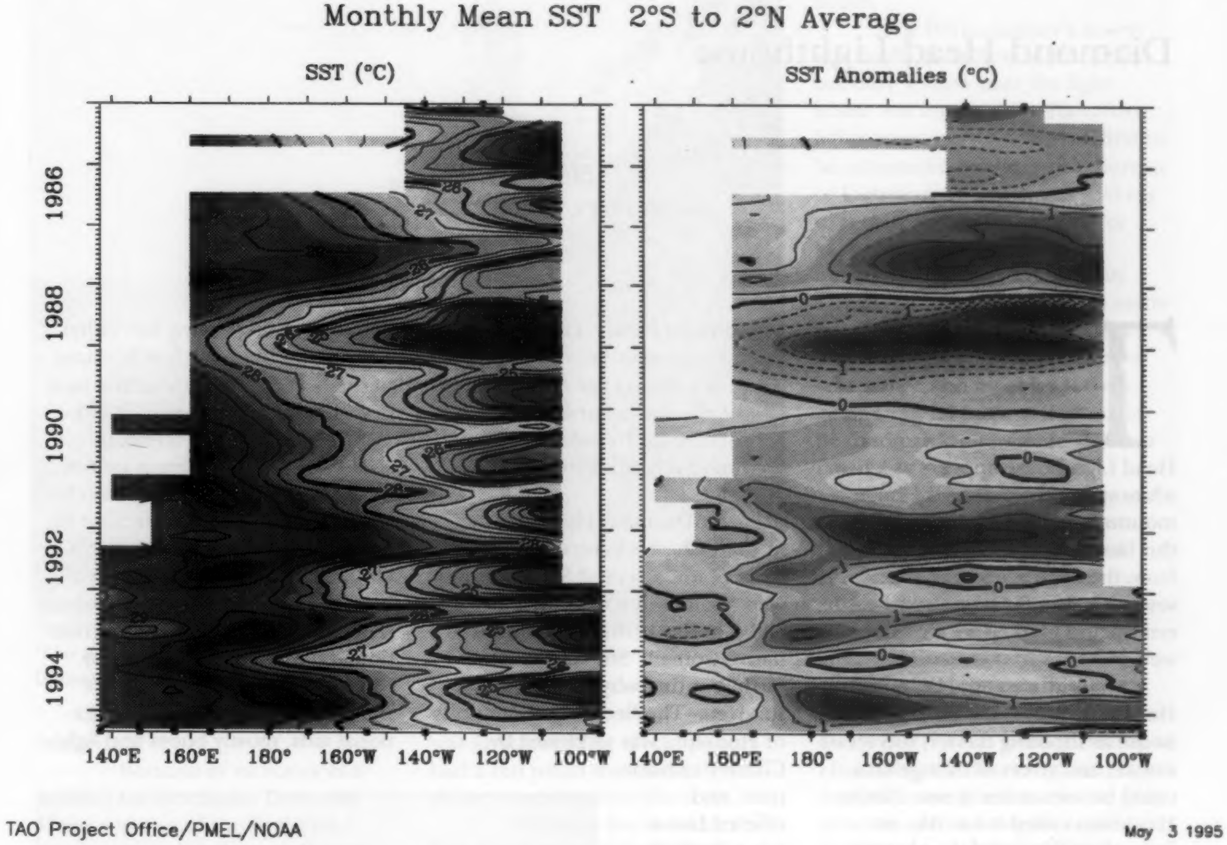


TAO Project Office/PMEL/NOAA

These two charts compare conditions in a relatively normal January (1991) and an El Niño January (1992). In the normal January above, notice the warm water in the Western Pacific Ocean along with weak westerlies and the cool water in the Eastern Ocean accompanied by easterlies. The lower panel above shows the anomalies indicate a near-normal situation. Contrast this picture with the chart below for January 1992. The Western Pacific Ocean warm water has spread eastward as the west winds have strengthened. The "cold tongue" in the Eastern Pacific has weakened and the anomalies give a good indication of just what takes place during an El Niño year.



TAO Project Office/PMEL/NOAA



The chart above is a comparison of monthly mean sea surface temperatures and their anomalies near the equator during recent El Niño years. These comparisons provide an indication as to which El Niño years were the strongest and this is more easily recognized by the anomalies. Notice the potent 1988 El Niño. The Real time Graphics from the TAO array of moored buoys in the Equatorial Pacific Ocean were provided by Dai C. McClurg and Nancy N. Soreide.

Ocean. The winds in the Western Pacific are very weak (see the arrows are indicating the direction from which the wind is blowing), and the winds in the Eastern Pacific are blowing from the east toward Indonesia. The bottom panel of the January 1991 plot shows anomalies, the way the sea surface temperature and wind differs from a normal January. In this plot the anomalies are very small indicating a normal January.

January 1992 was a peak of an El Niño year (left, bottom). The warm water (top panel of the plot) has spread from the western Pacific Ocean towards the east in the direction of South America, the "cold tongue" (lower panel) has weakened, and the winds in the western Pacific, usually weak, are blowing strongly from the west, pushing the warm water eastward. The anomalies show clearly that the water in the center of Pacific Ocean is much warmer than in a normal January.

El Niño years are easier to see in the anomalies which show how much sea surface temperature is different from the usual value for each month.

It is possible that 1995 may also be an El Niño year.

Diamond Head Lighthouse

Elinor De Wire
Gales Ferry, Connecticut

Tourists arriving in Hawaii by air are treated to an aerial vista of Diamond Head. Far below, the Diamond Head Lighthouse appears as a tiny white spike dwarfed by the huge mountain behind it. Since 1899 this beacon has warned ships away from the coral reefs that extend several miles off Oahu's southeastern tip and blinked a welcome as well.

Centuries ago, Diamond Head was its own natural lighthouse as shooting flames, turrets of smoke, and rivers of orange lava could be seen miles at sea. Native Hawaiians called it *Lae Ahi*, or "wreath of fire," and they kept a navigational bonfire lit near its summit to guide fishermen and war canoes. Their homecoming was announced to the tiny village of Honolulu by a chain of conch shell blowers.

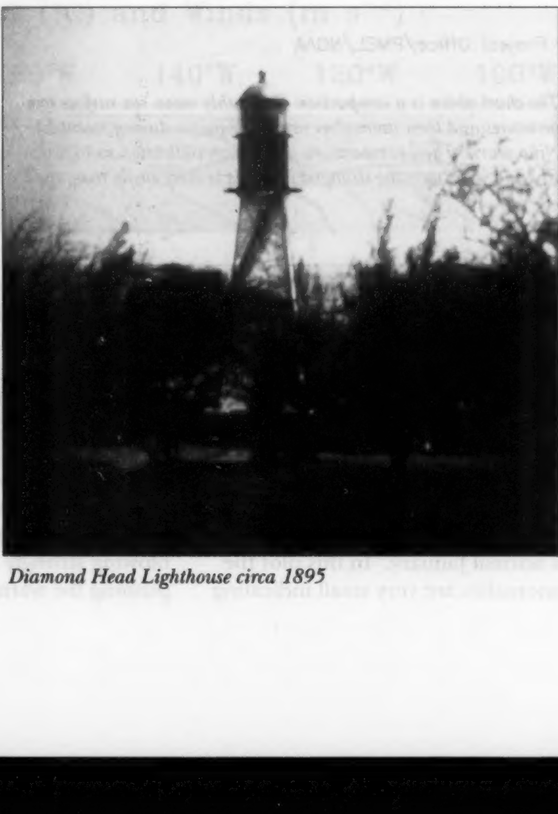
When British sailors scaled the volcano's 232-meter slopes in 1825, they found hard, clear calcite crystals among the black lava rocks. These were quickly mistaken for diamonds, and the name Diamond Head was coined, though some mapmakers continued to use the Hawaiian name.

With the increase in commerce to Hawaii in the 19th century, island merchants established a lookout station on the south slope of Diamond Head. The idea was more profit-motivated than benevolent, but the keeper of the station, whose job was to announce the arrival of ships by means of signal flags, also relayed distress calls to Honolulu.

"Diamond Head Charley," as John Charles Peterson was nicknamed, was a retired Swedish sailor who had put down his anchor in Oahu in the 1870s and married a native woman. She died in childbirth, but the baby, named Melika, survived. The fledgling community of Honolulu was saddened by Charley's misfortune, and offered him a job as lookout on Diamond Head at $50 a month.

Charley and his little daughter lived in a tiny cottage on the southern slope of the mountain. Melika walked along Waikiki Beach — then a quiet and sparsely populated strand — to get to school each day. She spent her leisure hours fishing and swimming and helping her father. Charley devoted much of his time to the big telescope Honolulu businessmen had given him as a gift.

But even his telescope could not see the changes on the horizon. The Hawaiian monarchy fell in 1893 with the deposition of Queen Lilioukalani, and in 1898 Hawaii became a U.S. territory. Within a decade, its relaxed Polynesian charm gave way to modernization and a fast-paced economy. Among the first improvements sought by Congress were navigational aids, mostly buoys and light-



Diamond Head Lighthouse circa 1895

"One of the best backyards in the world, Diamond Head Lighthouse continues to signal "aloha" out over the Pacific Ocean.

houses.

Because of its status as a landfall for Honolulu, Diamond Head was one of the first sites selected for a lighthouse. Several wrecks off the point had convinced shipping interests that the beacon was crucial to safety. The SS ***Miowera*** was among these. It grounded on the reef on a black, moonless night after steaming too close to shore looking for the familiar profile of Diamond Head. The great steamship ***China*** had also foundered here, trying to make landfall from the south.

In 1899, the quaint little lookout tower was upstaged by the long-awaited Diamond Head Lighthouse. Honolulu Ironworks fabricated the iron framework and lantern. The tower stood 44 meters above sea level and mounted a third-order prism lens which was illuminated by oil lamps and had a red panel inserted in it to shine a warning over the reefs.

Within a few months, the first lightkeeper, John Kaukaliu, reported that the tower was unstable in high winds and asked to have it strengthened. The open framework was enclosed with brick. Kaukaliu was paid $75 a month and traveled to the lighthouse every day from his home in Kaimuki. Diamond Head Charley continued to live in his little cottage by the lighthouse until his death in 1907.

In 1910 the beacon was upgraded to an incandescent oil vapor system.

By World War I, cracks had appeared in the brick walls of the lighthouse, and money was appropriated for a new tower. It was completed in 1918 at a cost of $6109.

In 1921 a keeper's house was finally built next to the tower, but only 4 years later the lighthouse was automated. Hawaiian lighthouses were among the first to be automated by the thrifty Bureau of Lighthouses, which was looking to recoup savings in salaries for keepers and upkeep on their homes. According to historian Love Dean, "Automation was made possible because of the development of highly efficient incandescent lamps and reliable electric-generating equipment that could be used in case commercial power failed."

The empty keeper's house at Diamond Head became the home of the superintendent of Hawaii's lighthouse district, who admitted he had one of the best backyards in the world. In 1939, after the Coast Guard assumed control of lighthouses in the U.S. and its territories, and the 14th Coast District was headquartered in Honolulu, the district's Commandant expressed interest in the pretty house with its elegant arched doorways and polished wood floors. Commandants of the 14th district have resided in the house ever since.

Today, Diamond Head Lighthouse continues to signal "aloha" over the opaline reefs off Oahu. It was placed on the National Register of Historic Places in 1980 and is a popular subject with tourists and photographers. The beacon is especially beautiful at night when its amber beam sweeps over the water like the eye of some great bird of paradise.

NOAA Ship *Malcolm Baldrige*

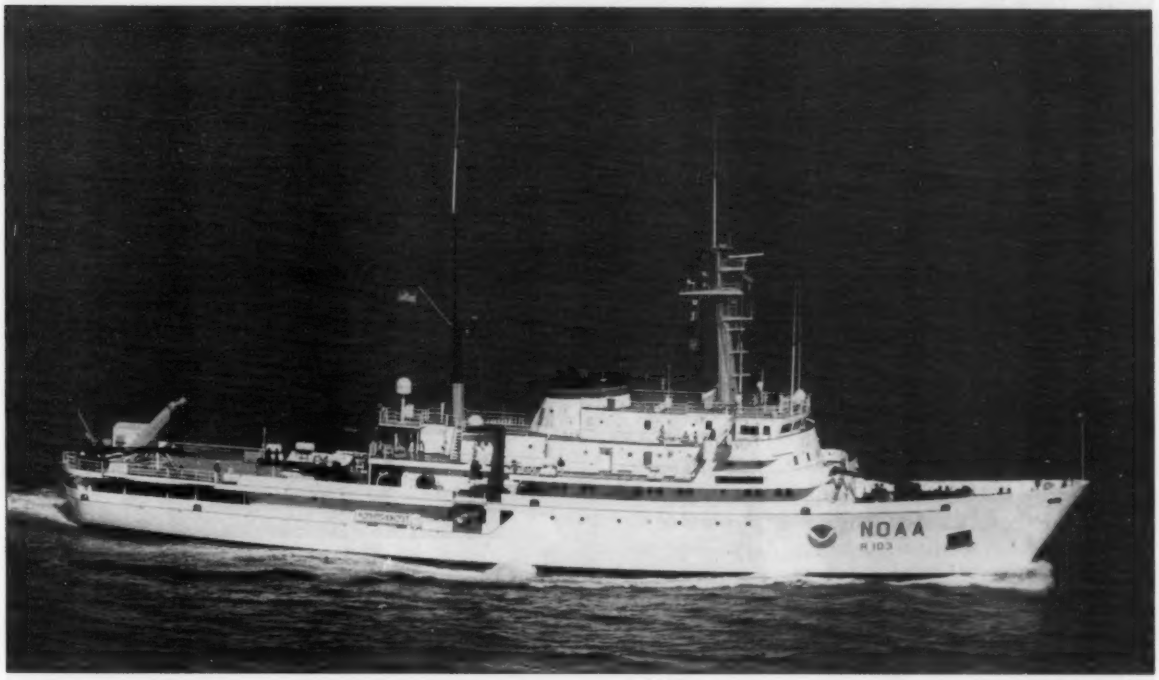
Charles Henson
PMO Florida

NOAA Ship ***Malcolm Baldrige***, one of the United States largest and best equipped oceanographic research vessels, left Miami, Florida on February 13, 1995 for an around-the-world scientific expedition to gather data integral to solving some of the world's most pressing environmental problems. These investigations include: Where does all of the carbon dioxide go when we burn fossil fuels? Is the Indian Ocean a carbon dioxide source or a carbon dioxide sink? How does the circulation in the Indian Ocean affect the world's climate? What pollutants are in the air overlying the worlds oceans?

The National Oceanic and Atmospheric Administration (NOAA), the largest agency in the U.S. Department of Commerce, is sending the ship on a 12-month voyage to fulfill one of its prime missions: searching for the solutions to many of the most critical environmental problems, including the greenhouse effect and potential global climate change. During the year, scientists from NOAA, other U.S. oceanographic research institutions, and from foreign countries will sail on the ***Malcolm Baldrige*** in search of answers to environmental problems.

Circumnavigating the globe, the vessel will make 14 port calls in eight countries and the American territories of Puerto Rico and Samoa. The first leg of the trip is from Miami, Florida to San Juan, Puerto Rico. During that leg, the ship will be taking water samples and current measurements to study the dynamics of the North Atlantic Ocean circulation.

En route to Durban, South Africa from Puerto Rico, the ship will be sampling Radiatively Important Trace Species (RIT) –sampling the air for compounds such as nitrogen, carbon dioxide, ammonia and aerosols. Scientists will sample the North Atlantic northeasterly and South Atlantic southeasterly trade winds and the polar westerlies to gain a broad view of the photochemical environment. This sampling is important to understand the complex components of our atmosphere and to provide a baseline to see how the composition of our atmosphere changes over time. Along with this study, the ship will take water samples and examine current flow for the



A floating laboratory, **Malcolm Baldrige,** *is 87 meters long, with a beam of 16 meters, a draft of 5 meters, and a displacement of 2963 tons. On some of the cruises during the year, the ship will provide accommodations for 10 commissioned officers, 43 crew, and up to 29 scientists. A scientific data center, laboratory vans, and two DEC Alpha 3,000 workstations share space with the crew.*

World Ocean Circulation Experiment (WOCE). From these data the interrelationships among the ocean currents, atmosphere, and world climate can be studied.

After departing Durban, South Africa, the ship will head to Colombo, Sri Lanka. Along the way, more WOCE data will be collected. From Sri Lanka to Muscat, Oman scientists will collect and study the plankton and fish in the region along the coast of Somalia to Oman. This project will utilize satellites to provide near real-time data that the scientists will need in the area of operations. This region is important because of the increase in the abundance, distribution, and diversity of animals produced by the strong coastal and open ocean upwelling generated by the southwest monsoons. A Multiple Opening and Closing Nekton Environmental Sampling System (MOCNESS) will be towed astern of the ***Malcolm Baldrige*** during the cruise to collect the plankton samples required.

More WOCE data will be collected on the leg from Muscat, Oman to the Seychelles and from the Seychelles back to Oman. After departing Oman, the ship will again tow MOCNESS to collect plankton samples and sample fish along the Somalia coast on its way to Diego Garcia.

Ocean and Atmosphere Carbon Exchange Studies (OACES) will be conducted from Diego Garcia to Fremantle, Australia and back to Colombo. OACES examines the amount of carbon dioxide in the atmosphere at a point to determine if the ocean in a given area is absorbing or emitting carbon dioxide and at what rate these processes are occurring. This information will help answer questions about the greenhouse effect and the possibility of global warming.

From Sri Lanka, the ship will transit to the Solomon Islands with a stop in Port Darwin, Australia. The Solomon Islands are being used as a supply point for the last project in the world cruise. Deep sea oceanographic buoys will be loaded on board for deployment

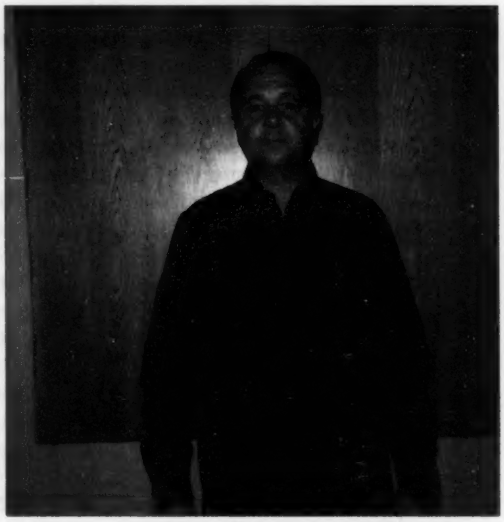
in the Western and Central Pacific Ocean. These buoys will be placed in the Tropical Ocean Global Atmosphere-Tropical Ocean Atmosphere (TOGA-TAO array. This is an array of more than 60 buoys that extend from Indonesia to just west of the Galapagos Islands. The TAO array measures surface winds and temperature, subsurface thermal structure, and currents. This information is recorded and reported by the buoys and used as a key diagnostic tool for understanding and predicting the El Nino phenomena. The last supply point for this project will be American Samoa and after a month of buoy operations, ***Malcolm Baldrige*** will head for Panama to cross the Caribbean Sea. The ship is scheduled to arrive back in Miami, Florida in mid-January 1996.

The NOAA ship is basically a "floating laboratory." The self-contained laboratory vans on the stern will accommodate specialized sampling, processing, and analysis equpment not available as permanent installed equipment on the ship. The scientific computer system for the ship consists of two Digital Equipment Corporation (DEC) Alpha 3000 workstations. These computers, operating at 225 (mHz), have over 40 individual sensors connected to them providing data and computational power to the scientists.

The commissioned officers aboard are members of NOAA Corps, the Nation's smallest uniform service. The 400 officers of the NOAA Corps command NOAA's ocean-going fleet, pilot NOAA aircraft and serve in a variety of scientific and management positions with NOAA laboratories and offices ashore.

Mistaken Identity
Our apologies to Greg Matzin and John Bolinger for the slip up. The distinguished gentleman on the right is Greg Matzin, Marine Program Manager at NWS, Alaska Region, not PMO John Bolinger as was reported in the Winter 1995 issue. John Bollinger's equally attractive photo will be appearing in the Summer issue of the Log.

Below right is Seattle's new PMO Pat Brandow.



Vince Zegowitz (on far left) welcomes the many attendees at the PMO Conference in San Diego. Also in attendance were Port Meteorological Officers, program managers and specialists from the National Weather headquarters and regional offices, the National Ocean Survey, the AMVER program and COMSAT. Forecasters from the National Meteorological Center, the National Hurricane Center, and Weather Service Office San Diego also attended. From Canada, a representative from its VOS program was present.

New PMOs Pat Brandow (Seattle), John Bollinger (Newark); New York Vacancy

We are pleased to announce that Pat Brandow has been selected as PMO for the port of Seattle, Wa. Pat has over 28 years of experience in meteorology and oceanography, with the U.S. Navy as an aerographers mate, and at the NWS office in Seattle.

Most of Pat's Navy career was spent in the western Pacific, split between duty aboard ship, and at major military installations. His most memorable time was August 1978, during the monsoon season at Cubi Point, Philippines, when it rained almost 457 mm in one 24 hour period (2504 mm for that month). Pat and his wife Lina have two children, and enjoy the outdoors of the Puget Sound region.

John Bollinger is the new PMO for Newark, N.J. John reported for duty April 17, 1995.

The vacancy for PMO New York, should be filled by late spring, 1995.

PMO Conference A Big Success

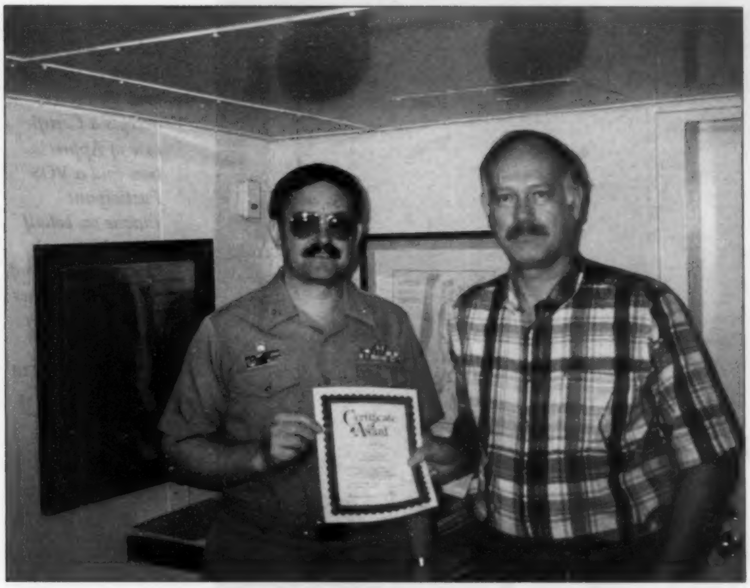
The annual VOS/PMO program meeting was held in San Diego, CA during the last week of March 1995. It was attended by PMOs, program managers and specialists from NWS headquarters and regional offices, the National Ocean Survey, the National Climatic Data Center, the NOAA Corps, the AMVER program, and COMSAT. Forecasters from the National Meteorological Center, the National Hurricane Center, and Weather Service Office San Diego also attended. A representative from the Canada VOS program was also present. A total of 35 people attended.

The presentations, discussions and dialogue were very thorough and well prepared, resulting in many constructive ideas and suggestions for program improvements. There was a guided excursion to the Scripps Institute Of Oceanography. The hotel and conference facilities at bay-side in San Diego were nearly ideal. This was a very valuable, productive meeting.

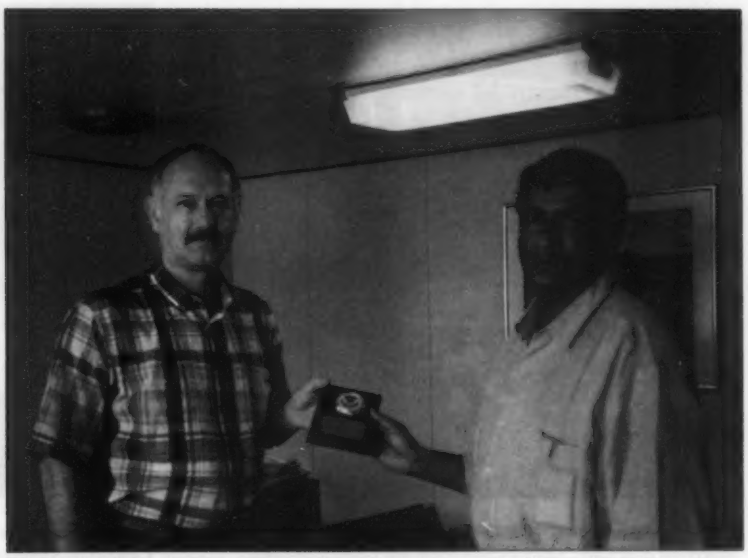
Survivors of the SEAS '95 Meeting held in Laurel Lakes, Maryland. L-r, front row: Bob Decker (Seattle, WA), Chris Noe (HQ), Sammy Moussa (HQ). L- r, middle row: Bob Benway (Narragansett, RI), Jill Wagoner (HQ), Mike Szabados (HZ). Back row, l-r: Gary Soneira, Warren Krug (Miami, FL), Darren Wright (HQ), Steve Cook (La Jolla, CA), Jim Farrington, (Norfolk, VA).

Chief Officer Hideki Iinuma and 2nd Officer Minoru Ota receive praise for their excellent work aboard the M/V **Pacific Maru** *(l-r), one of the best reporters in the NOS/VOS SEAS Program. It collects XBT data across one of the world's most data sparse regions.*

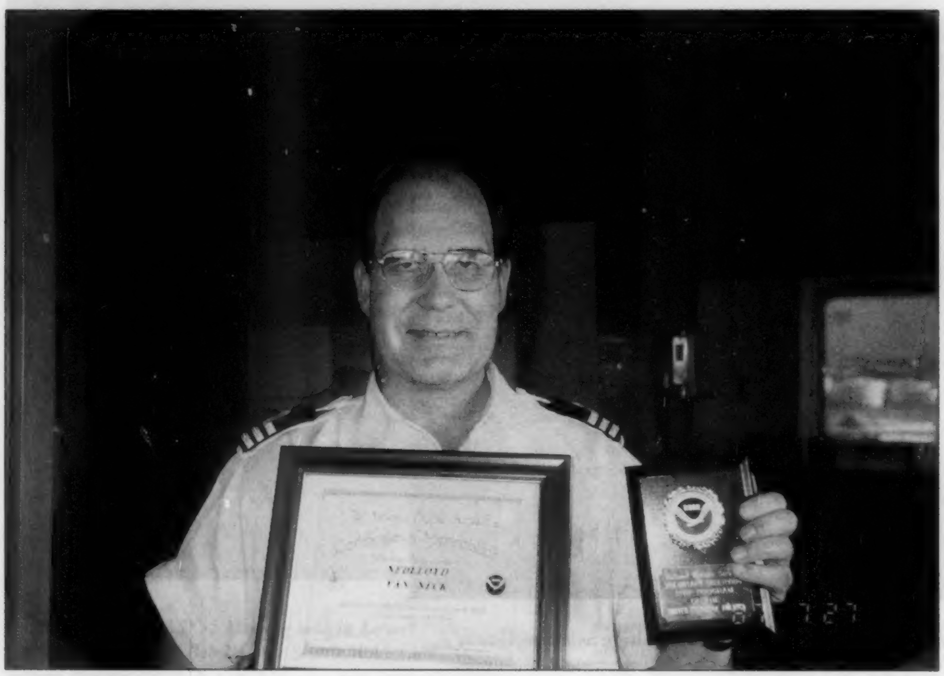
Captain Capitani (r) and the Radio Officer of the M/V **Southern Lion** *officially join the U.S. VOS/SEAS Program. All the* **Lion** *vessels collect XBT data on the very important north–south transect from Valdez, Alaska to Cape Horn.*



PMO Charles Henson presenting NOAA Ship Malcolm Baldrige *with certificate of appreciation for 1994 observations. The ship left for a year long around–the–world cruise the same day.*



Florida PMO Charles Henson presenting a VOS plaque to the Master of the ship, Erickousa Wave, in appreciation for joining the Volunteer Ship Observing Program.



Chief Officer Johannes C. Ulrich of the Nedlloyd Van Neck accepts a Certificate of Appreciation and a VOS Participant Plaque on behalf ot the National Ocean Service and National Weather Service for many years of "Outstanding" effort in SEAS VOS Program.

Participation Certificates were pesented to Bill Dawson, Quartermaster (l) and Capt. Dave Fowler (r) of the Canadian Coast Guard ship, **Samuel Risley**, *by Rick Shukster, PMO, Environment Canada. This vessel has participated in the U.S. SEAS Program for 2 years and Canda's weather obs program for many years.*

(L-r) Quartermasters Donald Lamondin and John Maynard of the Canadian **Samuel Risley** *accepting certificates of SEAS participation. Absent on leave were Quartermasters Roger Ritchie.and Jerry Gibson, who will receive their awards at a later date.*

Oceanographic Monthly Summary 1980–1995

Paul Reilly
National Ocean Service
Camp Springs, Maryland

The December 1994 *Oceanographic Monthly Summary* (OMS) was the last issue published. OMS, first published in 1980, was the result of an the expansion of a previous publication, ***The Gulf-stream***. During its life, various outside contributors participated in its charts and articles, in addition to the regular National Weather, Ocean and Satellite Services of NOAA.

The last issue was available in February 1995. Some of the OMS graphical information charts, though possibly in a different form, can be still be obtained from the sources listed in the box on the right.

The three regular monthly hand–analyzed charts/articles can be acquired by contacting the individual authors: This information (with possible modifications) should be accessible by either automatic fax machine or subscription to a distribution service.

Modified versions of data contained on various regional Sea Surface Temperature charts (pages 4-11, 16-17, and 20-23) can be obtained from the following publications: ***Integrated Global Ocean Services System Products Bulletin.*** This publication is sponsored by WMO–IOC and is produced monthly. It contains large scale charts of SST and climatological anomalies. Additional information can be obtained by contracting Yves Tourre by telephone at (904) 365-8812, or by e-mail at *tourre @ideo.columbia, sdu.*

Climate Diagnostic Bulletin is produced monthly by NOAA's Climate Analysis Center. For information, write: Climate Analysis Center, W/NMC52, World Weather Building, Room 605, 5200 Auth Road, Washington, D.C. 20746

The charts originally published in the OMS are no longer available. However, new versions of some of these charts are available on Internet. Procedures on how to access these can be explained by calling me at (301) 763-8294.

Alaska Region Ice Analysis
(pages 122-13),
Selina Nauman (301) 457-5313

West Coast Ocean Features
(pages 14-15),
Ernest Daghir (408) 656-1716

East Coast Ocean Features
(pages 18-19)
Jenifer Clark (301) 763-8294

Marine Observations—1994 in review

Martin S. Baron
National Weather Service

The year 1994 was very successful for the Voluntary Observing Ship (VOS) Program. Port Meteorological Officers (PMOs) recruited 180 new ships into the program and performed 5,456 ship visitations. U.S. radio stations relayed 390,000 ships weather observations to the National Weather Service Telecommunications Gateway in Silver Spring, Maryland. As of March 1, 1995, there were 1,488 vessels participating in the NWS VOS program, making it the largest VOS program in the world.

The breakdown by vessel type (using the World Meteorological Organization VOS designations):

Select - 456
Supplementary - 430
Auxiliary - 447
Great Lakes - 81
Local - 61
Platforms - 13

VOS program vessels can be divided by ocean area of operations:

Pacific - 551
Atlantic - 632
(includes Caribbean and Gulf Of Mexico)
Great Lakes - 81
Other - 224 (includes Indian Ocean, Mediterranean Sea, and vessels operating in both the Atlantic and Pacific oceans).

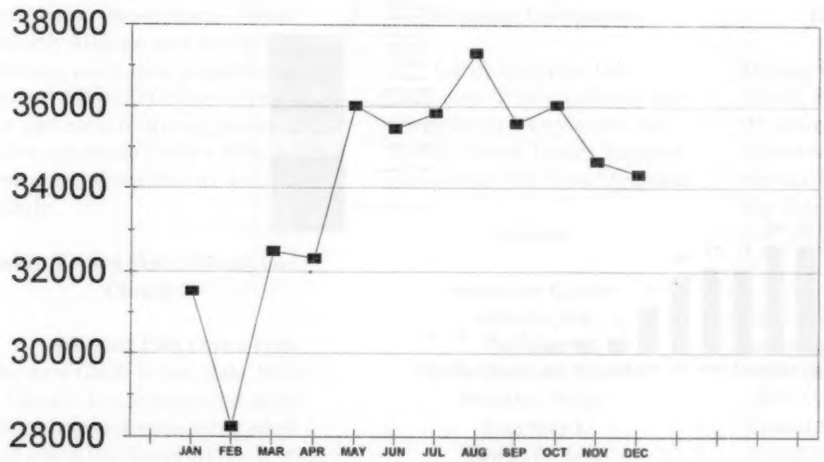
The vast majority of NWS VOS program ships (1,257 or 85%) are commercially owned cargo ships; 94 VOS program vessels are U.S. Coast Guard Ships, 78 vessels are U.S. Navy ships, 26 vessels are operated by the National Oceanic and Atmospheric Administration (NOAA Corps), and there are 33 vessels under miscellaneous ownership (such as Merchant Marine Academies and state and local governments).

Nearly 45% of ship weather reports are relayed through INMARSAT, about 18% using SEAS transmitters and GOES satellites, almost 12% through commercially operated shore radio stations, about 5% through U.S. Coast Guard shore radio stations, and just under 4% through the military. Miscellaneous sources account for about 19% of ship reports (most of these are INMARSAT or Coast Guard reports for which the source relay stations cannot be determined, so the INMARSAT and Coast Guard percentages are actually higher than indicated above).

There is an annual monthly variation in number of ship reports received by the NWS, with a pronounced winter minimum and summer maximum. See Diagram 1. This is probably because more vessels are operating during the summer months.

There are three categories of radio stations accepting ship's weather reports in the United States. These are (shown with their shore relay stations):

(1) INMARSAT - Niles Canyon, California; Santa Paula, California; Southbury, Connecticut; Staten Island, New York



Ship Reports received at National Weather Service Telecommunication Gateway (NWSTG)-January through December 1994

(2) **U.S. Coast Guard** – KPH (San Francisco), NMC (CAMSPAC), NMG (New Orleans), NMN (CAMSLANT), NMF (Boston), NMO (Honolulu), NOJ (Kodiak)

(3) **Commercial** – KLB (Seattle Marine), KFS (Half Moon Bay, California), WWD (Scripps Institute), WNU (TRT Slidell, Louisiana), WLO (Mobile Marine), WSC (Global Marine, West Creek, New Jersey), WCC (Chatham, Massachusetts), WLC (Rogers City, Michigan)

U.S. Coast Guard Group and small boat stations will also accept ships weather reports, but should only be contacted when none of the primary stations listed above can be reached.

The 5,456 ships visited by PMOs during 1994 can be divided as follows:

Vessels already in the NWS VOS program – 2,770

Vessels uninterested in participating – 1,370

Vessels in foreign VOS programs – 810 candidates for the VOS program – 330

Newly recruited VOS program vessels – 176

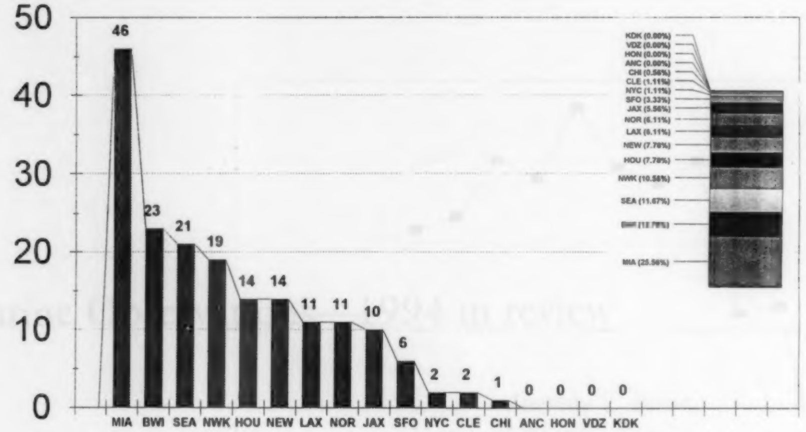
PMOs performing the most ship visits :

PMO New Orleans (Jack Warrelmann) – 880
PMO Baltimore (Jim Saunders) –694
PMO Los Angeles (Bob Webster) – 644
PMO Newark (Marty Bonk) – 620 (now PMO Norfolk)
PMO Miami (Chas. Henson) – 533

PMOs recruiting the most VOS program ships (top 5): (diagram 2)

PMO Miami (Chas. Henson) – 46
PMO Baltimore (Jim Saunders) – 23
PMO Seattle (Dave Bakeman) – 21 (Dave has since retired)
PMO Newark (Marty Bonk) – 19
PMO Houston (Jim Nelson) – 14
PMO New Orleans (Jack Warrelmann) – 14

Reminder On Loaned Equipment: Meteorological equipment supplied to vessels — barometers, barographs, sling Psychrometers, wind wheels, and sea-water bucket thermometers — are loaned to VOS program vessels taking weather observations. Since the equipment is expensive and hard to replace, please contact your PMO whenever your status as a VOS program participant is about to change. If you



These are the 1994 Voluntary Observation Program Recruits by Port. The total recruits were 180.

are no longer taking part in the program, an equipment pick-up, drop-off, or delivery will be needed. Equipment supplies are very limited. Please help ensure that equipment is accounted for and available for new recruits.

Report Accuracy, Timeliness, and Distribution Reminder

It is of paramount importance to ensure that your equipment is accurate and properly calibrated. A PMO should calibrate your barometer and barograph once every 3 months, and also check your psychrometer during every ship visit. Sea-water thermometers (whether hull-mounted or located in the condenser intake) should be calibrated annually, and checked every time your vessel is in the yard for service. If your vessel has an anemometer, it should be calibrated once every 6 months. Make sure the anemometer is located where the ships superstructure will not interfere with the air motion. When recording dry and wet bulb temperatures, always take your psychrometer to the windward side of the ship. This allows contact with air fresh from the sea which has not passed over the deck prior to your measurement.

Always transmit your observation without delay as soon as possible after you've observed the data. The meteorologist uses your report as indicative of current, up-to-date conditions at your vessel (so called real-time conditions). Make your observation as close to the reporting hour as you can. Any transmission problems or difficulties with radio stations should be reported to your PMO and written down in the appropriate space on the back of the B-81 Ships Weather Observations form.

Report arrival times tend to be later at night and for Southern Hemisphere reports. Please make every effort to improve the timeliness of these reports. Data is most readily available from the main shipping routes in both hemispheres. There is a chronic shortage of data from coastal waters out 200 miles (for this reason, 3-hourly reports are requested from U.S. and Canadian waters out 200 miles from shore). There is also a widespread shortage of data from the Southern Hemisphere and from the Arctic Ocean. More data is also needed from the

tropics and easterly trade wind belt (5-35°N), especially during the Northern Hemisphere hurricane season (May – November). From the North Atlantic and North Pacific Oceans, more data is needed at 0600 and 1200 UTC (these are late night and early morning times). If you are operating from a data sparse area, please report weather regularly.

Guide To Sea State, Wind, and Clouds

Ask your PMO for a copy of the new *Guide to Sea State, Wind and Clouds*. It was prepared as an aid for observers estimating wind speed using the Beaufort Scale and also to help identify cloud type. The brochure contains 67 color photographs (13 sea state, 54 cloud), and a glossary with terms and definitions.

Sea state photographs are in very short supply, and I am always anxious to receive them. Please label any that you send in with Beaufort Force and wave height. Also indicate where the photo was taken.

VOS Program Awards For 1994

We are pleased to announce that 40 Voluntary Observing Ships and 5 shipping companies will receive outstanding performance awards for observations and support during 1994. Congratulations! The selections were made by PMOs who submitted the names of the very best and most conscientious vessels/shipping companies to NWS Headquarters, where the final decisions were made. All Voluntary Observing Ships make important contributions. We regret that only a small number of vessels can be honored with an award.

Shipping Companies

Carnival Cruise line
Stolthaven (Perth Amboy), Inc.
Virginia Int'l Terminals, Inc.
Totem Ocean Trailer Express
Transportes Maritima Mexicana

Vessels

American Condor
Atlantic Star
Bebedouro
Bona Shimmer Seattle
Brooklyn Bridge
Courtney L
Edwin H. Gott
Torm Freya
Fetish Triton
Francis L
Golden Gate Bridge
Medusa Challenger
Merida
Michigan
NOAA Ship ***Delaware II***
NOAA Ship ***Miller Freeman***
Northern Lights
NOSAC Ranger
OOCL ***Inspiration***
Paul R. Tregurtha
President Monroe
Pride of Baltimore II
Rhine Forest
Rotterdam
San Marcos
Santa Paula
Sea Lion
Sea Mariner
Seaboard Universe
Sealand Enterprise
Sealand Express
Sealand Hawaii
Sealand Integrity
Sealand Trader
Skaugran
Sunbelt Dixie
USCGC ***Polar Sea***
USNS ***John McDonnell***

New Recruits
January - March, 1995

During the 3-month period ending March 31, 1995, PMOs recruited 98 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program. Thank you for joining the program.

Please follow the worldwide weather reporting schedule as best you can—report weather four times daily at 0000, 0600, 1200, and 1800 ZULU or UTC time. The United States and Canada have a 3-hourly weather reporting schedule from coastal waters out 200 miles from shore, and from anywhere on the Great Lakes. From these coastal areas, please report weather at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC, whenever possible. To transmit your weather report to the NWS, use

(1) INMARSAT Standard A or Standard C,

(2) U.S. Coast Guard Simplex Teletype Over Radio (SITOR), plain language (recite the coded message using radiotelephone), or high frequency Morse Code,

(3) Commercially operated shore radio stations (using SITOR or CW), as a back-up, if methods (1) or (2) are not available.

NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM 01 JULY 94 TO 30 SEPT. 94

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
ADM. WM. M. CALLAGHAN	KGYE	KEYSTONE SHIPPING	NEWARK, NJ
ARIZONA	V2MF	RIISE SHIPPING INC	JACKSONVILLE, FL
ATLANTIC SUPERIOR	C6BT8	T. PARKER HOST	BALTIMORE, MD
BELGRANO	P3HR2	PMO	HOUSTON, TX
BLED	J8EK	SPLOSNA PLOVBA PIRAN	SEATTLE, WA
BLUE SAPPHIRE	ELNV9	REDERI AB SUNSHIP	MIAMI, FL
CARIBBEAN MERCY	3FFU4	MERCY SHIPS	MIAMI, FL
CHEVRON OREGON	WNHL	CHEVRON SHIPPING CO	SAN FRANCISCO, CA
COLUMBUS CANADA	ELQN2	COLUMBUS LINE	LOS ANGELES, CA
CORNELIA MAERSK	OXIF2	MAERSK LINE	NEWARK, NJ
DELMONTE PLANTER	ELIT7	DEL MONTE FRESH FRUIT INTL.	MIAMI, FL
DODGE ISLAND	WYQ7951	NATCO	MIAMI, FL
DOLE COSTA RICA	ICRD	DOLE FRESH FRUIT INTL., LTD.	MIAMI, FL
DOLE HONDURAS	ICWF	STAN. FRUIT & STEAMSHIP CO.	BALTIMORE, MD
E.W. MCKINLEY	3EVY	EASTWIND SHIP MGMNT	MIAMI, FL
EVER RENOWN	3FFR4	EVERGREEN MARINE CORP.	LOS ANGELES, C
FALSTRIA	C6BD8	STAR SHIPPING (U.S.W.C.) INC.	SEATTLE, WA
GEORGE SCHULTZ	ELPG9	J. E. ASPEN SHIPPING CO.	BALTIMORE, MD
GOLD RIVER	LAFO4	WILLARD IVER, INC.	NEWARK, NJ
GULF CURRENT	ELMF9	SINGA SHIP MANAGEMENT	NEWARK, NJ
IBN AL-MOATAZ	HZLH	UNITED ARAB AGENCIES INC	BALTIMORE, MD
ISLA GRAN MALVINA	LQOK	DELEUSA	NEWARK, NJ
JOSEPH LYKES	3ELQ9	LYKES BROTHERS SHIPPING CO.	BALTIMORE, MD
MINERAL OSPREY	ELND2	ANGLO EASTERN SHIP MGMNT	MIAMI, FL
NORTHERN LION	A8IE	NORTH AMERICAN SHIP AGEN.	LOS ANGELES, CA
NOVA ZEELANDIA	C6LA7	NETWORK SHIPPING LTD	MIAMI, FL
OCEANUS OSAKA	3EQZ6	NYK LINE, NA INC.	NEWARK, NJ
ORIENTAL FERM	DZDB	DAKILA OCEAN NAV. CORP	MIAMI, FL
SAN ISIDRO	DIOR	IVARAN AGENCYS INC.	NORFOLK, VA
SEALAND GUATEMALA	OVJV2	BRANDTSHIOP USA, INC	MIAMI, FL
SENORITA	LADN4	UGLAND MARITIME	MIAMI, FL
SERAFIN TOPIC	ELBZ2	NEW ENGLAND SHIPPING CO	BALTIMORE, MD
SONORA	XCTV	OCEANS INTERNATIONAL	HOUSTON, TX
SONORA	XCJT	OCEANS INTERNATIONAL	HOUSTON, TX
SR. DIRECTOR	XXXX1	ESCUELA NAUT DE TAMPICO	HOUSTON, TX
SR. DIRECTOR	XXXX2	ESCUELA NAUT DE VERACRUZ	HOUSTON, TX
TEAL ARROW	C6KB8	WESTFLEET MANAGEMENT	NEWARK, NJ
USCGC STEADFAST	NSTF	COMMANDING OFFICER	SEATTLE, WA
USNS COMFORT	NCOM	MILITARY SEALIFT COMMAND	BALTIMORE, MD
VISAYAS VICTORY	DZVP	STAR SHIPPING (NY) INC	BALTIMORE, MD
VOROSMARTY	HAAT	MASSAN SHIPPING	BALTIMORE, M
WESTERN LION	A8BN	NORTH AMERICAN SHIP AGEN	LOS ANGELES, CA
YUCATAN	XCUY	OCEANS INTERNATIONAL	HOUSTON, TX

High Seas Atlantic Broadcasts Expansion

Lee Chesneau
Marine Forecast Branch
National Weather Service

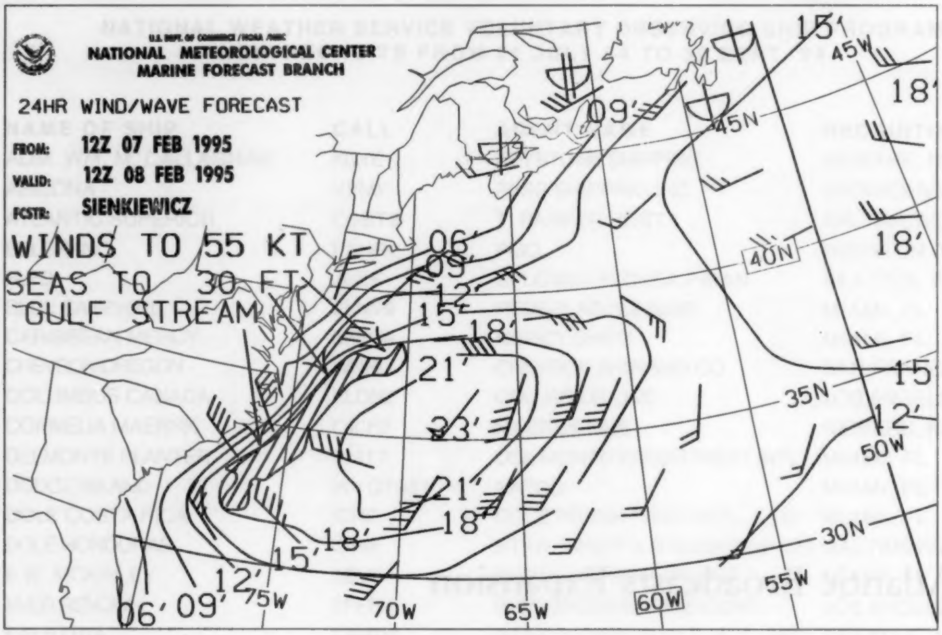
In cooperation with the U.S. Coast Guard at Marshfield, Massachusetts, the Marine Forecast Branch (MFB) at the National Meteorological Center, Washington, D.C. will be revising and expanding its high seas Atlantic broadcast later this year. Some new products will be added to the existing product suite and some of the present products may be modified. We are soliciting feedback from Atlantic mariners so we can determine whether an overlay of the Gulf Stream, its warm and cold eddies, and the Labrador Current represent an improvement or impedes the information being conveyed on the 24-hour Wind/Wave Forecast chart. These features will also be overlayed to the new 6-hour Wind/Wave Forecast chart to be added to the radiofax program later this year. The expanded broadcast time will also allow the MFB to broadcast with greater frequency a detailed Gulf Stream Analysis from three times weekly as we currently broadcast to perhaps twice daily.

The enclosed examples are representations of an actual 24-hour Wind/Wave Forecast from earlier this winter. The first example (top right) represents what we actually transmitted on February 7, 1995. The 24-hour Wind/Wave Forecast for this date depicts enhanced conditions along the north Wall of the Gulf Stream with arrows pointing to an enclosed hatched area.

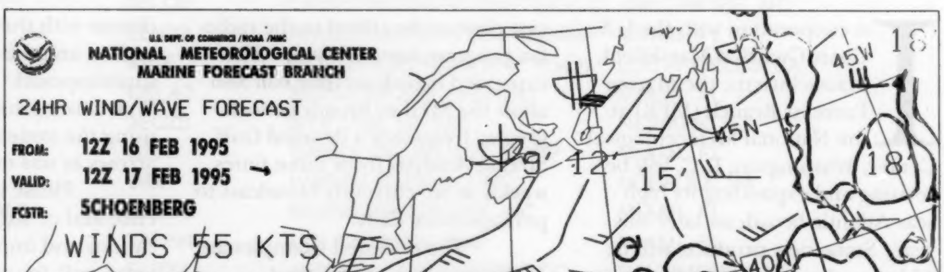
The second example (bottom right) duplicates the exact conditions with the Gulf Stream, its eddies, and the Labrador Current superimposed. Enhanced North Wall conditions are also depicted using the same area by the solid arrows as was noted above.

Please indicate your preference and or suggestions for modifications and improvement. You can write, call, fax or e-mail your response to:

Marine Forecast Branch
National Meteorological Center
Washington, D.C. 20233
Attn: Dave Feit
(301) 763-8442
Fax (301) 899-8903
email: dfeit@smtpgate.ssmc.noaa.gov



Wind/Wave Forecast from winter 1994. The 24-hours forecasts enhanced conditions along the north wall of the Gulf Stream with arrows pointing to an enclosed hatched area.



Report from the North Atlantic

Stew Arkwell
Chief Petty Officer First Class
Maritime Command Headquarters
Halifax, Nova Scotia, Canada

The barograph chart and corresponding surface analyses were submitted by HMCS ***Toronto***, one of Canada's newest warships, en route to Halifax, Nova Scotia after a tour of duty in the Adriatic. The charts show the vessel's run through a strong North Atlantic storm.

The weather observations received at METOC Halifax, the Canadian Navy's Atlantic Fleet Meteorological and Oceanographic Analysis Center, allowed us to track and forecast the movement of this storm with quite a good degree of accuracy compared to many open ocean storms. The information transmitted ashore was used extensively in producing the charts and forecasts produced for our Halifax HF/LF (FAX) and (RATT) broadcast. The lesson continues to be—and technology hasn't yet replaced it – that ships' weather observations their way ashore continue to be an important, if not the most important, part of the Marine Weather Watch in the North Atlantic.

The ***Toronto***'s weather associated with this January 1995 storm was as follows (only one chart is shown and all times are UTC):

24/1800 position: 42.4°N, 51.8°W, pressure1001.1 millibars, continuous light rain, wind 090/11 knots, southwesterly swell 3 meters.

25/0000 position: 42.6°N, 53.5°N, pressure 975.7 millibars, showers past hour, wind 170/32 knots, waves 3 meters, swell from the east at 2 meters.

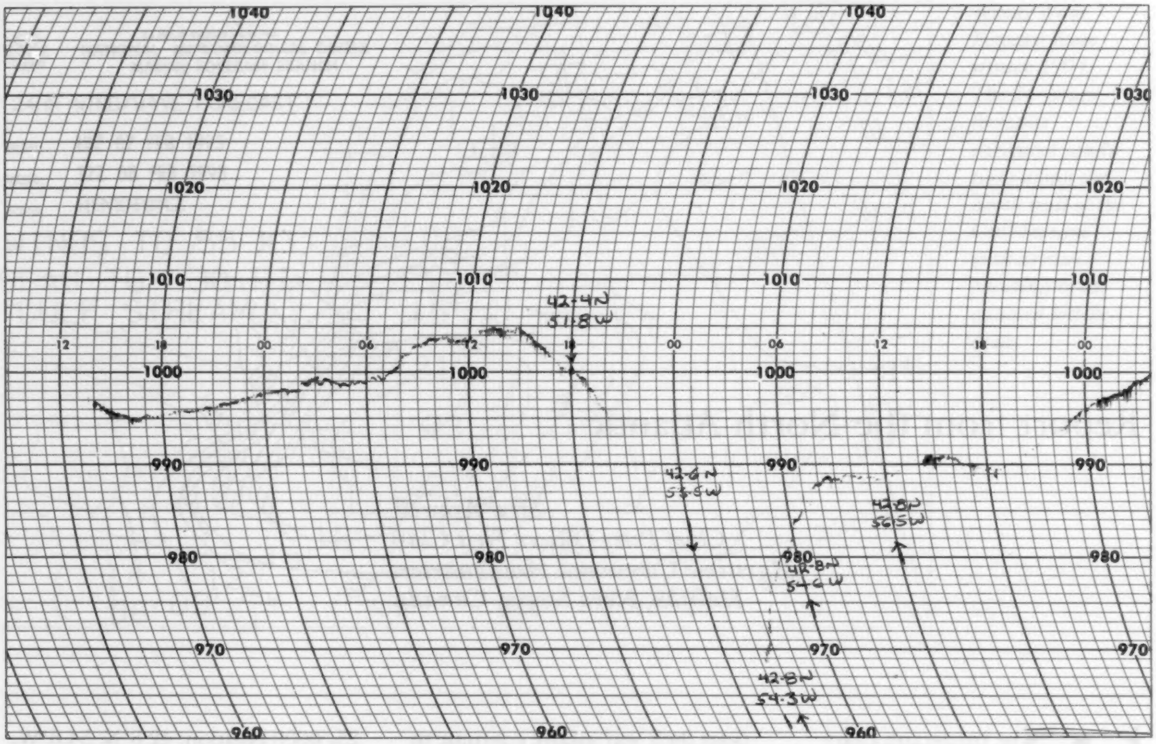
25/0300 position: 42.8°N, 54.3°W, pressure 975.0 millibars, showers, wind 270/60 knots (gusts to 90 knots reported verbally), waves 7 meters.

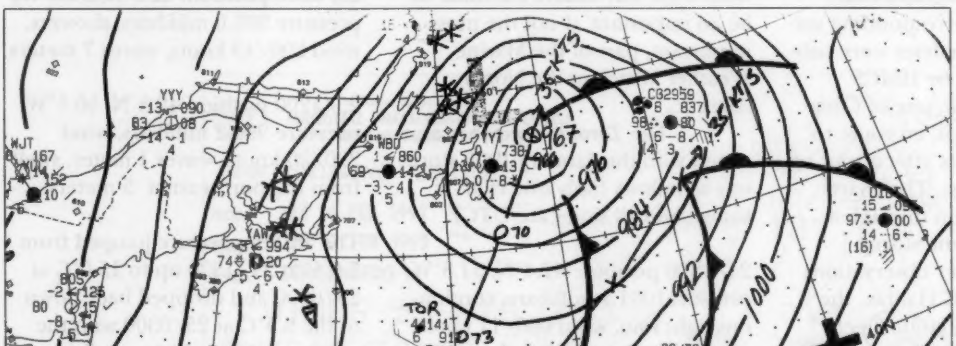
25/0600 position: 42.8°N, 54.6°W, pressure 985.0 millibars, showers, wind 290/43 knots, waves 7 meters.

25/1200 position 42.8°N, 56.5°W, pressure 990.2 millibars, wind 290/20 knots, waves 1 meter, swell from the northeast at 5 meters.

The air temperature jumped from 7.5°C at 24/1800 up to 15.0°C at 25/0000 and dropped back down to the 6.5°C at 25/0300 with the passage of the cold front. Sea surface temperatures were 5.0°C at 24/1800, 12.6°C at 25/0000 and 11.1°C at 25/0300.

The ship incurred no damage during this storm. Although we don't generally recommend that any ship sail through this type of powerful winter storm, the importance of getting the information ashore, if you do, cannot be over emphasized.





*The barograph chart above shows the progression of the **Toronto** through the January 1995 North Atlantic storm. At the time of its lowest pressure report, just after 0200 on the 21st, it was more than 150 miles southwest of the storm's center. The Surface Analysis (left) is for 25/1200 when the **Toronto** was at 42.8°N, 54.6°W, with a 985.0-millibar pressure, showers, and a wind of 43 knots from the west northwest. Waves were estimated at 7 meters.*

Mediterranean "Hurricane" Revisited Times Two

I am as intrigued as you appear to be over the Mediterranean "hurricane" shown on the inside of the back cover of the recent issue of the *Mariners Weather Log* [Winter '95]. I do not, however, believe that the weather system shown was a tropical cyclone, and I also do not believe the system of January 26, 1982 was, either. We cannot encourage mariners to believe that tropical cyclones, as we normally understand them, occur in the Mediterranean and certainly not in January.

In fact, systems with cloud patterns that look, superficially, like those of a tropical cyclone are not uncommon over western Europe. Indeed, one occurred yesterday, as you can see from the enclosed print-out of a NOAA visible image received by the satellite station at Dundee University, Scotland, at 1332 UTC yesterday. This was certainly not a tropical cyclone. It was, in fact, a fast-moving wave depression (a "secondary"), which originated over the ocean southeast of Greenland and produced several inches of snow over Wales and central England! I obtained the satellite image via the World Wide Web using the URL http://www.sat.dundee.ac.uk/bin/browseroot.

I thought at first your Mediterranean "hurricane" was a polar low, as these weather systems do tend to have the 6 on 9 cloud pattern as seen from a satellite. However, an inspection of the weather charts available in the quality newspapers–I do not have better weather maps than those for mid-January–do not support the idea. A wake vortex downstream of Italy, the Dalmation Mountains or even the Alps is possible. Weather systems very like your Mediterranean "hurricane" quite often appear east of southern Greenland when winds over Greenland are strong northwesterlies. If you look back at satellite images for the past month or so, you will find this happened several times recently.

As I said at the beginning of my letter, the "hurricane" is intriguing. I hope someone can come up with a satisfactory explanation–but tropical or subtropical cyclone, I doubt very much.

J.M. Walker
Senior Lecturer
University of Wales
College of Cardiff
e-mail: walkerjm@cardiff.ac.uk

We have received some observations from the U.S.S Edenton, which will appear in the next issue. –ed.

Dundee visible image, March 3, 1995 at 1332.

This preliminary report is compiled from warnings issued by the National Hurricane Center, Central Pacific Hurricane Center, Naval Western Oceanography Center, Fiji Meteorological Service, Meteorological Service of New Zealand, the Joint Typhoon Warning Center, Japanese Meteorological Agency, Bureau of Meteorology, Australia, Philippine Meteorological Service, Royal Observatory of Hong Kong, Indian Meteorological Department, Reunion Meteorological Service and the Mauritius Meteorological Service.

The North Pacific and North Atlantic are not included, except in the table, since we carry detailed summaries of these basins as feature articles. While an effort has been made to make sure this information is as accurate as possible, it was drawn from operational warnings that may not always agree with information published after the storm is over. A more detailed summary is available on the Internet. Text copies of past weekly summaries can now be retrieved via FTP from squall.met.fsu.edu. They can be found in the directory pub/jack. Please address any questions or comments to Jack Beven at Internet addresses: beven@hrd-tardis.nhc.noaa.gov or jbeven@delphi.com.

A digitized version of the weekly summary with DMSP polar orbiting imagery is available over the World Wide Web. This is courtesy of Greg Deuel at the DMSP satellite archive. It can be found at: http://web.ngdc.noaa.gov/ under the Weekly Updated Items section of the DMSP Satellite Archive home page.

For more information on the imagery and how to retrieve the digitized summary and images by other methods, please contact Greg Deuel at Internet address: gbd@po-box.ngdc.noaa.gov.

Tropical Cyclone Summary for October, November and December 1994

Jack Beven
National Hurricane Center

October 1994

North Indian Ocean

Tropical Depression: A tropical depression formed over the Bay of Bengal near 16°N, 83°E on October 4th. This system reached a peak intensity of 30 knots before it moved inland over India later that day. The depression persisted over eastern India for several days as it tracked northwest, north, and then northeast. It finally weakened to a low pressure system near 23°N, 82°E on October 8th. While there are no reports of significant winds, Machilipatnam, India reported a minimum pressure of 993 millibars at 0000 on the 5th of October.

South Indian Ocean Basin (west of 135°E)

Tropical Depression: A tropical depression formed near 9°S, 52°E on October 5. The system moved westward on the 5th and 6th, then it turned west-northwestward on October 7. It dissipated later that same day near 6°S, 44°E. Maximum sustained winds in this system were estimated at 30 knots.

North Indian Ocean

Tropical Cyclone 04B: A tropical depression formed near 10°N, 85°E on October 29. Initially moving west-northwestward, the system turned northwestward the next day. Rapid strengthening ensued, and the system reached both tropical storm and hurricane intensity on October 30. At the end of the summary period, TC-04B was near Madras, India, moving northwest with 65-knot winds. The cyclone continued northwestward and weakened to a low pressure area over land on October 31. While that was the end of the system as a tropical cyclone, the residual low produced heavy rains over southeast India for several more days. This storm affected the eastern coast of India. Madras reported 40-knot sustained winds and a pressure of 994.3 millibars at 2100 October 30. Higher winds and lower pressures probably occurred between the 3-hourly reports.

Press reports indicate that TC-04B caused at least 138 deaths (and possibly as many as 240) in the Indian states of Tamil Nadu and Andhra Pradesh. Twenty-six people died in Madras, with the other casualties resulting from river flooding elsewhere in southeastern India.

Author's note: There are major disagreements between intensities reported by the Indian Meteorological Department and the Joint Typhoon Warning Center. The IMD gave this system the designation of "severe cyclonic storm with a core of hurricane winds," which is their term for 65 knots or greater intensity. JTWC indicated a peak intensity of 35 knots.

November 1994

North Indian Ocean Basin

Tropical Depression: A tropical depression formed near 10°N, 84°E on November 4. The cyclone

moved west northwestward and crossed Tamil Nadu coast of India on the 5th. The system weakened to a low pressure area over land later that day. Maximum sustained winds in this system were estimated at 25 knots. There are no reports of damage, casualties, or significant weather with this system.

Tropical Cyclone 05A: A tropical depression formed over the Arabian Sea near 10°N 66°E on November 15. Initially stationary, the system started a west southwestward motion the next day as it reached tropical storm strength. TC-05A turned westward on the 17th, and this motion continued until it made landfall in eastern Somalia on November 19. TC-05A reached a peak intensity of 65 knots just prior to landfall. The storm continued westward and dissipated over land on the 20th. There are no meteorological reports available from the landfall region. Press reports indicate that 75 people were killed in northeastern Somalia. In addition, 50 more people were reported killed due to flooding in the Red Sea port of Djibouti as the remains of the system moved over that area.

South Pacific Ocean Basin
(east of 135°E)

Tropical Cyclone Vania (TC-01P): TC-01P formed near 11°S, 171°E on November 12. Moving south southwestward, the system turned toward the west-southwest with 35-knot winds by the 13th. The system was named Vania by the Fiji Meteorological Service on November 14 as it turned southward. Vania continued southward on the 15th as it quickly strengthened to a peak intensity of 75 knots. Rapid weakening followed, and by the end of the day it was back to tropical storm strength. Vania drifted southwestward on the 16th and became nearly stationary near 19°S, 168°E. The cyclone then moved west northwestward on the 17th as it weakened to a depression. It dissipated later that day near 19°S, 166°E.

Vania affected parts of the Republic of Vanuatu. Lamap on Malekoula Island reported 33-knot sustained winds and a 993.6-millibar pressure at 0600 on November 15. There are no reports of damage or casualties at this time.

South Indian Ocean Basin
(west of 135°E)

Tropical Cyclone Albertine (TC-02S): Tropical Cyclone 02S formed near 7°S, 76°E on November 24. Initially moving southerly, the system turned southwestward the next day. Albertine then moved south southwestward and reached hurricane intensity on the 26th. On the 27th, over the open Indian Ocean, winds reached 115 knots. This turned out to be the peak intensity. The storm turned toward the southwest while weakening on November 28. The cyclone turned southward on November 30 as it weakened to a tropical storm. The southward motion continued until the system became extratropical near 26°S, 62°E on December 2.

Albertine affected Diego Garcia Island during its development. The island reported a gust to 34 knots at 2300 November 25 and a minimum pressure of 1001.4 millibars at 0100 on the 26th. There are no reports of damage or casualties at this time. Albertine affected Rodrigues Island during its weakening stage. The island reported 48-knot sustained winds at 0600 November 30 and a minimum pressure of 1000.8 millibar 6 hours earlier. Ship DDOJ reported 52-knot winds and a pressure of 998.5 millibars at 0000 November 25, while ship DCLX reported 45-knot winds at 1800 on the 23rd. Although Albertine affected Diego Garcia and Rodrigues (as well as these ships), there are no reports of damage or casualties at this time.

December 1994

South Indian Ocean Basin
(west of 135°E)

Tropical Cyclone Annette (TC-03S): A tropical depression formed near 13°S, 116°E on December 14. Initially quasi-stationary, the system started a southward drift the next day as it reached tropical storm intensity. Annette moved south southeastward on the 16th as it reached hurricane strength, then it turned southeastward the following day. Annette accelerated southeastward and moved inland over northwestern Australia on December 18 as it reached a peak intensity of 95 knots. The storm dissipated over land the next day.

There are few available observations near the landfall point. La Grange Mission reported 60-knot sustained winds and a pressure of 999.9 millibars at 0700 December 18. There are no reports of damage or casualties at this time. Special thanks to Dr. Chris Landsea and Dr. Greg Holland for passing some additional data on Tropical Cyclone Annette (TC-03S). As the storm made landfall, Mandora reported a peak gust of 117 knots and a minimum pressure of 933 millibars (time of obser-

vations unknown).

South Pacific Ocean Basin
(east of 135°E)

Tropical Cyclone 04P: A tropical depression formed near 11°S, 172°E on December 13. The cyclone followed a southeastward track through its lifetime. TC-04P reached tropical storm strength on December 15, with a peak intensity of 45 knots on December 16. The system became extratropical near 26°S, 171°W on December 17. This system passed through the Fiji Islands. The large circulation produced several reports of 995- to 1000-millibar pressures, but there were no reports of tropical storm force winds. There are no reports of damage or casualties at this time.

Tropical Cyclone William (TC-05P): Tropical Cyclone William formed near 13°S, 163°W on December 31. Initially moving south southeastward, the system turned toward the south-southwest on the 1st of January and maximum winds were estimated at 55 knots. William turned southeastward on January 2 as it reached a peak intensity of 60 knots. The storm then turned east-southeastward and became extratropical near 26°S, 148°W on the 3rd.

William was moving through the island groups east of Samoa during its development. William affected several island groups east of Samoa. Aitutaki Island reported 42-knot sustained winds at 0300 January 2 and a minimum pressure of 975.0 millibars 3 hours later. Mauke Island reported 50-knot sustained winds and a pressure of 983.6 millibars at 1200 January 2. Ship FNIK reported 40-knot sustained winds and a 977.8-millibar pressure at 1500 January 2. There are no reports of damage or casualties at this time.

Worldwide Tropical Cyclones—October, November and December 1994

Name (number)	*Basin*	*Dates*	*Est. Maximum Winds*
Seth (32W)	Western North Pacific	10/2–10/12	120 knots
Trop. Dep.	North Indian	10/4–10/8	30 knots
Trop. Dep.	South Indian	10/5–10/7	30 knots
Rosa (19E)	Eastern North Pacific	10/8–10/15	90 knots
Verne (33W)	Western North Pacific	10/15–11/1	115 knots
Teresa (34W)	Western North Pacific	10/16–10/26	80 knots
Wilda (35W)	Western North Pacific	10/20–11/1	135 knots
Yuri (36W)	Western North Pacific	10/23–10/27	45 knots
Zelda (37W)	Western North Pacific	10/28–11/8	140 knots
TC4B	North Indian	10/29–10/31	65 knots
Florence (11)	North Atlantic	11/3–11/8	85 knots
Trop. Dep.	North Indian	11/4–11/5	25 knots
Gordon (12)	North Atlantic	11/8–11/21	70 knots
Vania (TC–01P)	South Pacific	11/12–11/17	75 knots
TC5A	North Indian	11/15–11/20	65 knots
Albertine (TC02S)	South Indian	11/24–12/2	115 knots
Axel (38W)	Western North Pacific	12/13–12/27	100 knots
TC–04P	South Pacific	12/13–12/17	45 knots
Annette (TC–03S)	South Indian	12/14–12/19	95 knots
Bobbie (39W)	Western North Pacific	12/17–12/26	50 knots
William (TC–05P)	South Pacific	12/31–1/3	60 knots

All times unless noted are UTC (universal time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world and in Hurricane Alley. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports and attempt to highlight the most significant ocean features each month. The track charts are provided by NOAA's National Meteorological Center. If an extratropical storm is particularly bad for shipping, we may designate it as the Monster of the Month.

–ed.

North Atlantic Weather October, November and December 1994

October–The most significant feature on the Northern Hemisphere mean surface pressure chart was the southerly position of the Azores-Bermuda High which opened up an alley for cyclonic activity which stretched from the Gulf of Maine/Gulf of St. Lawrence area to the North and Norwegian Seas. On the mean 500-millibar chart a trough was apparent over the western North Atlantic with an axis along the 60th meridian.

The following storm summary was provided by Jack Bevin of the National Hurricane Center.

Gulf of Mexico Cyclone: A low pressure system formed over the central Gulf of Mexico near 24°N, 88°W on September 30. Initially moving northwestward, the Low turned northward the next day. The low moved to the mouth of the Mississippi River on October 2, then it headed east northeastward to a landfall near Pensacola, Florida.

This system had an unusual structure. Rawinsonde data indicated that the Low had a warm core at low levels similar to a tropical cyclone, but there was little circulation in the upper troposphere. The system featured persistent strong convection at large distances from the center, but it was never able to form organized convection near the center. The Low also lacked a tightly-wound low level circulation. Aircraft and surface data indicated the radius of maximum winds was 160 miles on October 2. This is more typical of a subtropical or monsoon cyclone than of a tropical cyclone. The low also featured troughs that somewhat resembled fronts although there was little or no temperature gradient along them. This system seems to have been a hybrid low with features of both tropical cyclones and frontal lows.

This cyclone affected the southeastern United States. The automated station at Cape San Blas, Florida reported maximum sustained winds of 39 knots with gusts to 53 knots between 1700–1800 on the 2nd. Tallahassee, Florida reported a gust of 50 knots in a severe thunderstorm at 1923 that same day. Reconnaissance aircraft reported a band of 50- to 60-knot winds at the 1500-foot flight level south of the Florida Panhandle on October 2. Based on all available data, maximum sustained winds are estimated at 40- to 45-knots. Flood-producing rains occurred along the track, with a storm total of 195 millimeters (7.68 inches) at Tallahassee and 185 millimeters (7.30 inches) at Dauphin Island, Alabama. Several tornadoes occurred over northern Florida and southeast Georgia with some damage reported. Coastal flooding was also reported in southeast Louisiana.

The Low moved off the Atlantic coast near Savannah, Georgia early on October 3. The rapid east northeastward motion continued until the Low passed north of Bermuda on 4th. The system then turned northeastward and lost all tropical characteristics near 37°N, 54°W late that same day.

This Low continued to have an unusual structure while over the Atlantic. Rawinsonde data from Bermuda continued to indicate a mid-tropospheric warm core, and surface observations suggested that the surface circulation became more tightly wound up. However, satellite imagery suggested that the system was merging with a cold front during this period. It thus appears that this low never fully acquired tropical cyclone characteristics.

The low tracked over or near several Atlantic surface stations. Buoy 41004 reported a minimum pressure of 994.9 millibars with sustained winds of 40 knots at 0800 on October 3. An automated station at Frying Pan Shoals (off of the North Carolina coast) reported 51-knot sustained winds with gusts to 59 knots between 1100 and 1200 the same day. Bermuda reported a minimum pressure of 997 millibar at 0753 UTC October 4, with sustained winds of 38 knots gusting to 58 knots at 0744. Based on the available data, the peak intensity of this system is estimated at 45 to 50 knots.

The ***Rinban*** (36.°N, 51.1°W) ran into 55-knot southerlies at 0000 on the 5th. By the 6th the center, now over Iceland, had an estimated pressure of 959 millibars— as wicked extratropical storm. Its pressure gradient was enhanced significantly by a huge 1036-millibar High, whose center was moving through the English Channel. Vessels were reporting gales and strong gales over the North and Norwegian Seas. At 0600 on the 6th, the **LFCV** (65.2°N, 07.2°E) encountered 52-knot winds in 4-meter seas. The ***Cumulus*** (53.6°N, 20.5°W) reported 48-knot southerlies in 7-meter seas at 0300 on the 6th. The system continued northeastward and began to weaken somewhat although pressure gradients remained very tight over the North and Norwegian Seas until the 8th.

Like the previous storm, this long-traveled storm had its origins in the Gulf of Mexico. It was actually detected on the 8th just southwest of Brownsville, Texas. It spent the next 5 days traversing east northeastward across the Gulf of Mexico as a weak 1010-millibar system. After stalling off Tampa Bay on the 12th, it finally headed northeastward and after crossing Florida, skimmed the southeastern U.S. coast before turning out to sea near the Outer Banks of North Carolina late on the 14th. After dipping southward it turned eastward and began to organize on the 16th as it passed just south of Bermuda. The Low then turned northeastward and by the 17th the 985-millibar crossed the 35th parallel near 60°W. Gale and strong gale reports were plentiful while the **WRYL** and **VSBN7** both hit storm force winds in the vicinity of 35°N, 67°W. Seas were being reported in the 6- to 10-meter range.

By the 18th pressure was estimated at 981 millibars, and by the 19th the 994-millibar storm passed over the Grand Banks and turned toward the east northeast. Its pressure dipped to 970 millibars on the 20th as it turned eastward along the 55th parallel. The **ZCAX3** (56.7°N, 40.1°W) hit 43-knot northerlies in 4-meter seas and 7-meter swells at 2100 on the 17th. The storm continued eastward but began to weaken somewhat. It crossed Ireland on the 22nd as a 981-millibar Low and then swung northward across England and the western North Sea. It moved into the Norwegian sea on the 24th.

The weather was particularly rough over the northern shipping lanes from about the 16th through the 23rd as another storm had proceeded the Brownsville Low. This system had its origins on the 12th over southern Newfoundland and by the 15th was a 984-millibar Low east of northern Newfoundland. On the 17th this center and another combined into a 991-millibar Low and then intensified rapidly that day and the following. By 1200 on the 18th it was a 968-millibar storm centered near 55°N, 20°W. This intensification was noted by the **OXYL2** (59.2°N, 43.1°W) which reported 60-knot winds in 10-meter seas at 1800 on the 17th. Most vessels were reporting 40- to 45- knot winds in 3- to 5- meter seas. On the 19th the system began to weaken as it turned east southeastward and the following day a 985-millibar center brushed southern Ireland and headed through the English Channel.

Casualties— In the Detroit River the 261-meter Great Lakes ore carrier ***Roger Blough*** was blown aground in 40-knot winds just north of Fighting Island in early October. The anchors would not hold in the river's clay bottom.

November— The Icelandic Low put in a strong appearance on this month's mean sea level pressure chart with anomalies of up to -6 millibars. Its center was south of Greenland and its large circulation spelled problems for mariners traversing the northern shipping lanes. This trouble was substantiated on the mean 500-millibar level where a large trough dominated the North Atlantic north of 40°N with its axis extending from Greenland southward.

On the 5th a Low came to life over the Gulf of Sr. Lawrence. It moved rapidly east northeastward and by 1200 the following day

was crossing the 40th meridian as a 986-millibar Low. It continued to intensify and by 1200 on the 7th its central pressure was down to 966 millibars near 50°N, 30°W. Just west of the center, the **BKJ7** encountered storm force winds in 11-meter swells. The storm had just turned toward the east southeast and was nearly paralleling the 50°N latitude band. It weakened somewhat the following day, but its broad circulation dominated most of the eastern North Atlantic from Iceland to 35°N. To its southwest was Hurricane Florence. Near gale force winds were being reported out to 600 miles from the 973-millibar center. At 1200 on the 8th the **3XCUY**, some 350 miles south of the center, hit 40-knot winds. Shortly thereafter the storm began to turn toward the British Isles. It was weakening rapidly when it moved across southern Ireland and England on the 10th. Its intensity was soon matched by the extratropical remnants of Florence.

Florence began to turn extratropical late on the 8th as it crossed the 45th parallel near 35°W. It was moving toward the northeast, but the following day its 968-millibar center swung northwestward to begin a meandering clockwise semi loop. At 1200 on the 9th, the **C6IZ3** some 100 miles south southeast of the center encountered 40-knot winds in 6-meter seas and gales were being reported out to 600 miles to the southeast and north of the storm center on the 10th. On the 11th and 12th, the powerful storm came to a halt near 55°N, 40°W. At 1200 on the 11th, the central pressure dipped to 952 millibars. The **SKUN** some 400 miles to the south of the center battled 10-meter swells in gales while nearby the **LAHE2** encountered 13-meter swells. By the 12th another center had entered the circulation and the gigantic 972-millibar system began to move eastward then turned sharply southward and began to weaken.

While the previous storm was at its peak on the 11th, an atmospheric wave was forming along its frontal system to the south. This incipient storm raced northeastward and intensified so that by the 12th it had crossed the 55th parallel near 30°W with a 972-millibar center. It continued to move and strengthen rapidly and by 1200 on the 13th its 965-millibar center was passing th the southeast of Iceland. At 0000 on the 14th the Cumulus, some 500 miles south of the center, was reporting 30-knot southwesterlies in 3-meter swells. The system continued though the Norwegian Sea on the 14th and 15th, finally moving into Norway north of Trondheim late on the 15th.

The second half of the month saw the cyclonic action shift to the Denmark St. as storms tended to move on a nearly northward course through these waters. The first one came to life as a secondary center just south of Iceland on the 18th. It moved north northeastward across Iceland as a moderate 972-millibar center early on the 19th and exploded into a 954-millibar center by 1200. As far south as the ***Cumulus***' area of patrol (53.5°N, 18°W) winds were blowing at 40 knots with swells of 4 meters. The circulation covered the Greenland, North and Norwegian Seas as well. The system continued its rapid movement and was still sporting a 956-millibar pressure on the 20th as it crossed the 70th parallel near 10°W. It began to weaken the following day.

By this time another system had formed just south of Kap Farvel and by 1200 on the 21st its 969-millibar pressure center was heading northeastward into the Denmark St. It raced through the Strait the following day. Its circulation was enhanced to the east and southeast by a huge 1028-millibar High centered over northern Africa.

Meanwhile a system that can be traced back to the southern Hudson Bay on the 18th had moved out into the Atlantic off Labrador and began to intensify. By the 20th its central pressure was down to 962 millibar as it crossed the 45th meridian near 57°N and began to turn northeastward toward the Denmark St. By 1200 on the 21st, it was a raging 944-millibar storm in the Denmark Strait and in its wake a 969-millibar center formed off Kap Farvel. The entire circulation was enhanced by a huge 1029-millibar High centered over northern Africa. By the 22nd it was through the Strait with a 956-millibar center and was being trailed by the 968-millibar Kap Farvel center which soon assumed control. However, by the 23rd the whole system had weakened significantly bringing a short respite of sorts to the area.

On the 24th a small atmospheric wave formed along a cold front trailing from a 968-millibar Low in the southern entrance to the Davis St. This innocent looking wave began to gather its own circulation and headed northeastward. By the 25th it was a moderate sized 972-millibar Low crossing the 50th parallel near 40°W. Gales were being reported to the south and southeast of its center. By 0000 on the 26th it had turned northward toward the Denmark Strait with a 960-millibar center and by 1200 its central pressure plummeted to 948 millibars. Strong gales were being reported out to 600 miles to the

south by vessels such as the **CGKP9** and **ZOKE**. Swells were running 5 to 9 meters. The storm began to weaken somewhat as it moved through the Strait and by the 27th its central pressure was up to 976 millibars. Even at that the **DZSS2**, near 60°N, 25°W, encountered 45-knot winds in 9-meter seas.

Casualties— Tropical Storm Gordon was responsible for the beaching of the 154-meter Turkish freighter ***Firat*** about 1 mile north of Port Everglades on the 15th. The ship dragged ashore as seas were running 4 to 5 meters with winds gusts of 50 to 60 knots. Coast Guard and Navy helicopter crewmen saved nine sailors from a sinking Haitian freighter in the Straits of Florida during Gordon. Responding to a distress call a Coast Guard helicopter located the 54-meters ***Jeano Express***, en route from the Bahamas to Miami on the 14th, listing to starboard with its stern awash in 6-meter seas and 30- to 40-knot winds.

A barge loaded with 40,000 barrels of liquid asphalt was driven ashore on the Michigan coast during a late November storm. The 102-meter double-hulled steel barge, **A-410**, was forced ashore on the 27th near the Straits of Mackinac. Seas as large as 5 meters from the east were whipped by winds that reached 81 mph according to the anemometers on the Mackinac Bridge.

Two New England fishermen were killed just before Thanksgiving as the stern dragger ***Wanderer*** capsized and sank while entering Quick's Hole Pass off the cost of Massachusetts near Martha's Vineyard. They had encountered gales and 2- to 3-meter seas.

December— On the mean sea level pressure chart, the normally significant Icelandic Low was stronger than normal with negative anomalies stretching from southeast of Greenland to the Barents Sea. This certainly indicates a rough weather month for the mariners traversing the northern shipping lanes. This feature was reflected on the mean 500 millibar pressure chart by a trough which covered most of the Atlantic north of 40°N with its axis originating over Greenland and stretching south southeastward.

The month opened with an all out weather siege on Iceland and the Denmark St. A leftover 976-millibar Low which had originated over the U.S. toward the end of November, was southeast of Kap Farvel on the 1st generating gales and swells up to 12 meters between 45° and 50°N. The **SKUN**, some 600 miles south of the 968-millibar center encountered 35-knot winds in 12-meter swells at 1200 on the 1st. Nearby the **DEDD** reported 30-knot southwesterlies in 8-meter swells. The storm turned northward and moved through the Denmark St. on the 2nd as a 969-millibar Low. Shortly thereafter two other centers on either side of Iceland joined the circulation. This slow moving complex system dominated weather across the western North Atlantic for several days.

Meanwhile a Low which had developed as a frontal wave over the Midwestern U.S. on the 2nd moved into the Atlantic on the 5th off southern Newfoundland and began to intensify the following day as it crossed the 30th meridian near 48°N. It was on a recurving pattern heading northeastward then northward toward Iceland. By 1200 on the 6th, its central pressure was at 965 millibars. At 1200 the **DGDC** near 48.1°N, 21.8°W was racked by storm force winds in 6-meter swells. The ***Cumulus***, closer to the center, reported 7-meter seas. By 0000 on the 7th, the storm's central pressure was down to 946 millibars and 12 hours later it bottomed out at 942 millibars just south of Iceland. Strong gales were reported south of the center as the storm slowed and began to weaken slightly. It began to turn a counterclockwise loop south of Iceland. At 1200 on the 8th, it was still at 958 millibars but another 966-millibar center was forming to the north of Scotland. This Low moved northeastward into the Norwegian Sea, while the Icelandic center weakened considerably over the next 24 hours.

A slight respite followed as several moderate Lows traversed these waters. Then on the 12th a large Low intensified rapidly off Labrador. This system actually originated over Louisiana on the 10th and swung off the New Jersey coast as a weak 1010-millibar wave on the 11th. Once over the Gulf of St. Lawrence it began to deepen and by 1200 on the 12th its 974-millibar center was along the Labrador coast with a frontal system that trailed across Cuba. Moving northward the center dipped to 956 millibars by 0000 on the 13th. **ZCAW6**, some 300 miles to the south southeast encountered 45-kn winds in 8-meter swells. Twelve hours later the **VRKO** was blasted by 55-knot winds in 7-meter seas some 400 miles south of the 965-millibar center. which was heading for Kap Farvel. On the 14th and 15th, it moved through the Denmark St. but as a much weaker system.

On the 14th a small atmospheric wave formed along the

front trailing out of the previous system. It headed toward the east northeast then turned northeastward on the 15th. By 1200 on the 16th, it was a 990-millibar Low crossing the 55th parallel near 27°W. However, 24 hours later its central pressure was down to 949 millibars– a drop of 41 millibars in 24 hours, just south of Iceland. It remained potent as it crossed Iceland on the 18th. However, the system began to weaken rapidly as it turned eastward toward northern Norway on the 19th.

The second half of the month was almost a picnic across the North Atlantic compared to the first half. The one storm that did exact a heavy toll weatherwise across the North Atlantic began on the South Carolina coast on the 23rd as a 992-millibar Low and headed northeastward. It passed over the Grand Banks at 1200 on the 26th as a 980-millibar Low and then all hell broke loose. By 1200 on the 27th, the central pressure was down to 956 millibars and 24 hours later it was at 942 millibars. At 1200 on the 27th, the **WRYG**, about 300 miles south southwest of the center, was battling 7-meter seas in 45-knot winds while nearby the **WPK5** was fighting 6-meter swells. On the 28th at 1200, the **WPK5** was racked by 50-knot winds with 9-meter swells near 48.5°N, 20.8°W. Closer to the center a report of hurricane force winds was received near 53°N, 25°W from an unidentified vessel. By 0000 on the 29th, the 942-millibar center was heading for Scotland. The large circulation was affecting shipping over the entire eastern North Atlantic. The **GSBA** (45.8°N, 26.8°W) at 1200 on the 29th was measuring 45-knot winds in 6-meter seas, while nearby the **VRDU** was being clobbered by 9-meter swells. A 960-millibar center moved through the Orkney Islands on the 30th as the storm began to weaken.

Casualties—On the 8th the 9-meter sloop ***Lightfoot*** left New York for Bermuda and soon hit 80-knot winds, 12-meter seas and driving rain some 275 miles southeast of Cape Cod, Massachusetts. The leaking sailboat was dismasted by the high winds. The crew abandoned in a lifeboat when the list neared 90 degrees, but their EPIRB signal was picked up by the Coast Guard and their planes kept an eye on things until the ***Shin Kakogawa Maru*** arrived and performed a textbook deepdraft ship rescue. The vessel was bound for Iceland and voluntarily diverted approximately 10 hours from its course after being identified as a participant in the AMVER program.

The mv ***Salvador Allende*** sank on the 9th in stormy Atlantic seas. The entire 31-member crew abandoned the vessel when it started taking on water and began to list some 1200 miles east of the New Jersey coast. Several of the crew were spotted in life rafts and clinging to debris by search aircraft amid winds up to 60 knots and seas reaching 9 meters. The vessel sank at 1200 on the 9th. Survivors were picked up by several merchant vessels in horrendous conditions. Several bodies were also sighted. The search was disrupted on the 11th by a severe snowstorm. It was a mammoth rescue effort by American and Canadian forces, including the New York Air National Guard and up to 10 commercial vessels. Despite this effort, all but two of the crew perished.

The barge, **N-103**, being towed by the tug, ***Lady Ashley***, lost control of close to 100 containers and six vehicles which went overboard when it encountered rough seas and high winds near Haiti. The vessel was less than one day from its destination of Port-au-Prince.

The ***Hendrik B.*** was adrift with a heavy lost, leaking and its foremast broken near 61.9°N, 18.3°W on the 29th in heavy weather. An Icelandic Coast Guard crew boarded the vessel on the 30th to assist.

A former Russian warship was being towed but had to be cut adrift in heavy weather and was driven aground on a small island off Norway on the 24th.

The end of the month storms wreaked havoc in the North Sea. Two oil platforms sustained damage and the mv ***Linto*** sank off the Dutch coast on the 2nd of January 1995 after being abandoned by her crew in heavy seas. The five-man crew was picked up by a Swedish vessel. Also the Danish ro-ro ferry ***Dana Anglia*** was damaged. Heavy weather had forced the vessel with 639 passengers and 100 crewmen to reduce speed to a minimum. Several vessels including the mv ***Superiority***, mv ***Forthbank*** and mv ***Nova*** ran into trouble but survived in storm force winds and 15-meter seas off the Dutch coast. The lifeboat ***Alfred Krup*** ran into trouble about 15 miles off Borkum when returning from an emergency and drifted out of control in northwest winds of force 10-11. It was found and towed, but two of the crew had been washed overboard during the rescue mission. The bulk carrier ***Werfen*** had accommodation windows on two deck smashed by waves. Also a number of containers were damaged.

North Pacific Weather
October, November and December 1994

October– The mean surface pressure chart indicates a nearly normal month over the North Pacific with slightly above normal cyclonic activity in the Gulf of Alaska. On the mean 500 millibar chart, troughing is indicated over the Gulf of Alaska and extending from the Alaska Peninsula southwestward.

The month opened with a bang in the form of a 956-millibar Low centered near 50°N, 170°W. Among those vessels reporting storm force winds were the ELOG8, KHRK, BOAB, UNWL and the WPGE. The WPGE (54.9°N, 171.6°W) at 0600 on the 1st encountered 50-knot winds in 7-meter seas and 9-meter swells with a 987-millibar pressure. These reports continued through the 1st as the storm's central pressure dipped to 949 millibars by 1200. At 1200 the NMMJ (51.9°N, 176.3°W) ran into 50-knot northerlies in 4-meter swells and recorded a 982.8-millibar pressure. The 968-millibar system head northward on the 2nd and crossed the Alaska Peninsula early the following day. Once into the eastern Bering Sea it weakened rapidly and was absorbed by another Low which had developed north of its center. The new system continued northward over the next couple of days but its impact was minimal to vessels along the northern shipping routes.

This first storm was followed by another less potent system which rode the Aleutian Chain for the first few days of the month and then turned northeastward as a 985-millibar Low on the 5th across the Bristol Bay and on to the Alaska mainland. Its circulation maintained its cyclonic nature over the Gulf of Alaska into the 7th, when a 999-millibar Low developed just south of Kodiak Island. It merged with another center to the southeast and by 1200 on the 8th a northward moving 976-millibar storm was dominating the Gulf. At 0900 on the 8th, the WFJK (57.7°N, 143.0°W) reported 40-knot southerlies while battling 7-meter swells. Three hours later the KSFK (59.0°N, 144.6°W) measured a 50-knot southeasterly and by 1500 the WFJK's winds were up to 56 knots in 8-meter swells and 5-meter seas. The storm moved inland on the 9th across the Prince William Sound and dissipated

rapidly. During this period Typhoon Seth was clobbering Taiwan.

By the 12th former Typhoon Seth had become a 982-millibar extratropical storm over South Korea. Moving northeastward it crossed Hokkaido the following day. At 1200 on the 12th the **UURD** (43.9°N, 135.8°E) was nailed by a 60-knot northeasterly, but 6 hour later their winds dropped to 47 knots in 5-meter seas. The storm continued to maintain its identity as it moved eastward along the 50th parallel on the 14th and 15th. By 0000 on the 16th its pressure was down to 978 millibars. In the meantime another Low was out ahead of it. This system came to life on the 12th near 32°N, 170°E and began to intensify on the 14th. Heading northeastward its central pressure dipped to 977 millibars on the 15th and 974 millibars the following day. These two systems were dominating shipping weather activity across most of the North Pacific. In general winds were in the 40- to 50-knot range while swells were running 4 to 6 meters. Vessels reporting included the **WFLG, D9TP, KHRH, WEZH, ELJL3, D9SG, 3EJX9, 3ETA5** and the **ELOG8**. By 1200 on the 16th the easternmost storm was centered in the Gulf of Alaska while the extratropical remnants of Typhoon Seth were weakening near 55°N, 170°E. The eastern storm weakened the following day as it moved inland.

On the heels of these two systems, a 970-millibar storm came to life south of the Kamchatka Peninsula on the 17th. This intensification triggered a few strong gale reports from vessels such as the **A8LL** and **BHFL**. Most reports however were less than gale force south of the center. The storm moved into the Bering Sea on the 18th but then weakened as it approached Bristol Bay the following day.

During the second half of the month in the North Pacific tropical cyclone activity was more dominant than extratropical activity. However, on the 25th an interesting situation arose. Several moderate centers in the Bering Sea merged into one large multicentered system. A 976-millibar center was analyzed near 50°N, 160°W while 978-millibar centers were found over Adak Island and near Seward. This broad system covered most of the northwestern North Pacific and winds in the 40- to 45-knot range were common. The following day the storm organized into a single 964-millibar center near 53°N, 150°W and was still generating gales. While this was going on, to the south was Typhoon Verne, super Typhoon Wild, Tropical Storm Yuri and Tropical Storm Nona.

The extratropical Low persisted for several more days in the Gulf of Alaska and finally weakened as the month came to a close.

Casualties— Winds of 60 to 70 knots on October 26th snapped 19 mooring lines holding the Keystone Canyon to its dock in Astoria, Oregon blowing it across the Columbia River and up against the Astoria Bridge. This despite the best efforts of Captain and crew to bring the vessel under control.

Five Oregon-based fishermen died in late October when a 30-meter crab boat disappeared in rough weather in the Gulf of Alaska southeast of Kodiak. Winds were blowing at 30 to 50 knots in 7-meter seas. Also in rough weather in late October three West Coast fishermen lost their lives when the 15-meter steel-hulled gill netter ***Freda-M*** sank in rough weather some 50 miles west of San Francisco.

November— On the mean surface pressure chart the subtropical high was more dominant than usual in November. This is reflected in the large light gray area of positive anomalies. The Aleutian Low can be found stretching across the Bering Sea with a pronounced center in the Gulf of Alaska. These positive anomalies were also reflected at the 500 millibar level where a slight trough is noticeable with an axis along the International Dateline. The charts also reflect the northward shift of the primary storm track over the North Pacific resulting in above average cyclonic activity in the high latitudes.

A weak Low left over from October was located near 37°N, 160°E as the month opened. This system raced northeastward and intensified. By 1200 on the 2nd the 970-millibar center was near Bristol Bay and generating gales along the northern shipping lanes. By the time it reached Anchorage on the 3rd, pressure had dropped to 953 millibars and the circulation covered the entire Gulf of Alaska. At 1200 the **LATI4**, some 900 miles southeast of the center, encountered 40-knot south southwesterlies and gales were being reported out to more than 600 miles to the southwest. The storm remained potent into the 5th.

On the 4th a secondary center developed over the northern Gulf of Alaska and soon became a separate 968-millibar system heading eastward. It dipped southward on the 5th and then turned and moved over the Queen Charlotte Islands as a 982-millibar Low. The **LATI4** reported in again on the 5th at 1200 with 40-knot

winds while the **WRYE**, some 300 miles south of the center, ran into 6-meter swells in 30-knot westerlies.

In the western North Pacific weather was not much better. On the 3rd a Low moved across Sakhalin and into the Sea of Okhotsk. Over Kamchatka on the 4th, central pressure dropped to 968 millibars and its circulation extended well into the Pacific. The storm continued northeastward remaining mostly over land and pressure continued to fall, hitting 966 millibars on the 5th. By this time it was approaching the Bering St.

Three days later just off the Kamchatka Peninsula a land Low from Mongolia exploded into a 964-millibar monster by 1200 on the 7th and then dipped to 954 millibars some 24 hours later. Along with a potent frontal system, this storm was triggering gales and strong gales across the Bering Sea and over the northern shipping lanes. The **WSRL** (46.8°N, 173.8°E) was whipped by 35-knot winds in 4-meter swells. At 0000 on the 9th the **CGKM6**, nearly 900 miles south of the center, hit 45-knot west southwesterlies in 9-meter swells. This storm remained potent for only a few more hours as it began to dissipate.

On the 9th a Low developed near the International Dateline and headed northeastward toward Bristol Bay. It intensified on the 10th as central pressure dipped to 970 millibars over southwestern Alaska. It then turned southeastward and headed for the Gulf and the Alexander Archipelago. At 0000 on the 11th, its pressure dipped to 964 millibars and its circulation covered the Gulf of Alaska. However by the 12th, it was a barely recognizable feature east of Ketchikan.

On the 14th a Bering Sea storm was analyzed at 964 millibars near 60°N, 180.° This system, which was nothing much up until the 14th, had formed near 40°N, 150°E late on the 12th and raced northeastward paralleling the Kuril Islands and Kamchatka Peninsula. By 0000 on the 14th, it was generating gales in the Aleutians and across the northernmost shipping lanes. The **9HAS4** (49°N, 160°E) ran into 40-knot westerlies in 3-meter seas. On the 15th central pressure was at 967 millibars but by now the storm was passing St. Lawrence Island on its way to the Seward Peninsula.

During the mid part of the month a mammoth multicentered wedge of high pressure was in control of a good part of the North Pacific. Finally on the 21st, a storm which had formed just west of Bristol Bay the previous day worked its way into the Gulf of Alaska and organized into a 980-millibar system. By 0000 on the 22nd its central pressure had dipped to 977 millibars and was causing problems throughout the Gulf of alaska. The **3EYY8** near 50°N, 155°W hit 35-knot northwesterlies in 4-meter swells, some 600 miles southwest of the center. The pressure gradient was tightest in the vicinity of the Alaska Peninsula where a land station was reporting storm force winds. The slowly moving storm finally made its way on to the mainland near Juneau on the 23rd.

At this time a major storm was coming to life some 500 miles east of the Kurils. At 1200 on the 23rd, a 992-millibar center was located near 47°N, 162°E. The system which had developed in the previous day was heading rapidly northeastward toward the western Bering Sea. It crossed the Aleutians on the 24th sporting a 989-millibar center. By 1200 on the 25th, pressure was down to 968 millibars but by this time the Low was centered near St. Matthew Island and closing on the Alaska mainland. It was broad enough however that its circulation extended over the northern shipping lanes where some gales and strong gales were reported. At 0000 on the 26th, the NGDF some 550 miles south of the center encountered 35-knot westerlies. Conditions eased on the 27th.

The month came to a close with the sudden formation and intensification of a Low which came to life on the 29th near 47°N, 153°W. It headed east northeastward and into the Dixon Entrance south of Ketchikan on the 30th, but its pressure plummeted to 966 millibars by 1200 and suddenly gales and strong gales were battering southeast Alaska and the eastern Gulf. While the storm edged inland, its ferocity continued into the 2nd of December.

Casualties— Four men were killed in separate accidents after Thanksgiving weekend near San Francisco as two heavily-laden crabbing vessels capsized and sank in heavy seas just west of Half Moon Bay. The 12-meter ***Lisa*** and 10-meter ***Best Girl*** sank in an area about 17 miles west of Pillar Point.

December— A large, stronger than normal Aleutian Low on the mean sea level pressure chart stretched from the California coast to Japan engulfing the Bering sea and Gulf of Alaska in anomalies down to -4 millibars. This was a sure indication of troubled waters at a troubling time of year. This same feature was reflected in a broad trough at the mean 500-millibar level and negative anomalies across the upper levels as well. In

other words the shipping lanes particularly in the north suffered from one end to the other.

Cyclonic activity came fast and furious during the first half of the month from the Kamchatka Peninsula to the Gulf of Alaska.

A Low came to life over the mid Pacific in the 3rd and moved rapidly northeastward to near the Kenai Peninsula. By 1200 on the 4th, it was a 968-millibar storm covering the entire northeastern North Pacific. Gales were being reported to near 40°N. At 0000 on the 5th, the **DYSN2** near 43°N, 139°W ran into 40-knot southwesterlies in 5-meter seas. Meanwhile, the **WNDB** was raked by 55-knot winds in 9-meter swells some 500 miles southwest of the 974-millibar center. The storm was starting to weaken as it turned southeastward and headed for the Alexander Archipelago and the Queen Charlotte Islands.

However, by this time two other centers were beginning to make their pressure felt in the western and central Aleutians. From the mid Pacific a northward moving Low dropped from around 990 millibars on the 6th to 956 millibars the following day as it entered the Bering Sea over the Rat Islands. Around the same time a Low from off Hokkaido had swung northward and dipped to 971 millibars on the 7th as it approached the western Aleutians. By 1200 on the 6th, the **LADB2** near 49°N, 162°E was reporting 35-knot northerlies. By 0000 on the 8th, the storm center was at 956 millibars and beginning to engulf the western center. The circulation dominated the weather from the Alaska Peninsula to the Kurils. Near gales were being reported as far south as 35°N near the dateline. Swells were in the 4- to 7-meter range with most reports in the southeast quadrant. It continued to move slowly northward after the merger but began to weaken slightly and was overshadowed by another system to the south.

This system developed on the 8th along the frontal system of the previous storm. It moved northward and intensified rapidly, becoming a 966-millibar Low moving into the Bering Sea near Atka Island. By the 10th it was down to 960 millibars but had also crossed the 55th parallel and moved over St. Matthew Island. However by this time it was being overshadowed by a 964-millibar howler near 50°N, 165°E.

This storm had come out of the Yellow Sea on the 8th and exploded a few days later. At 1200 on the 9th the central pressure near the southern Kurils was 984 millibars and by 1200 on the 10th the pressure dropped 38 millibars. Almost 1,000 miles to the southwest the KHRK was reporting 40-knot northwesterlies in 6-meter swells. By 0000 on the 11th the central pressure had risen to 950 millibars but 30- to 40-knot winds in 4- to 6-meter swells were common south of the center between 35° and 45°N. The potent storm continued on an east northeastward heading and while it filled it wasn't until the 13th when it hit southwestern Alaska that pressure climbed to 982 millibars. Up until that time this storm wreaked havoc across the northern shipping lanes.

To the south two moderate systems were tracking east northeastward across the Pacific. By the 15th a 964-millibar Low was centered near 50°N, 170°E while a 970-millibar system was crossing the 50th parallel near 150°E. Both were generating gales and the 964-millibar storm picked up a couple of hurricane force wind reports from the WPGE and the **JBEJ8**. They were also battling swells in the 10- to 12-meter range. Both began to fizzle somewhat on the 16th but another 966-millibar center appeared between the two. The system actually became quite complex and several centers developed within a circulation that stretched from Hokkaido to the Queen Charlotte Islands. Winds across the entire North Pacific on the 18th were in the gale to strong gale range, while swells ranged from 4 to 9 meters. The far-reaching influence was extensive. For example, at 0000 on the 18th the **LPG9** near 34°N, 167°E encountered 40-knot northwesterlies in 5-meter swells. By 0000 on the 19th, several centers in the east merged into one 950-millibar center in the Gulf of Alaska. At this time the **3EKL8** near 40°N, 165°W reported in with 50-knot winds in 6-meter seas. The central pressure of the Gulf of Alaska system dipped to 949 millibars by 1200 on the 19th. However, it weakened rather rapidly the following day as it headed across Cook Inlet. This was not to be considered a respite, however, as another system followed in its wake.

This storm had quietly come to life on the 19th in the mid Pacific, but by the 20th at 1200 it was sporting a 960-millibar center as it crossed the 50th parallel near 155°W and swung northward. It became the major center of a multicentered circulation over the northeastern North Pacific on the 21st. The circulation generated gales to 35°N and an active frontal system created even more problems. Weather improved somewhat on the 22nd as the system began to weaken.

It is impossible to cover all the storms of consequence this month, but on the 23rd a 968-mil-

libar Low appeared over the eastern Aleutians while on the 24th another 966-millibar system was recurving near Bristol Bay.

This storm came to life on the 25th and the following day was sporting a 956-millibar center near 50°N, and the dateline. It rode through the Aleutians and northward into the eastern Bering Sea on the 27th as a 952-millibar storm. Its very tight circulation, enhanced by strong Highs to the southwest and southeast of its center, resulted in many reports of gales and strong gales in these quadrants. Swells in the 7- to 10-meter range were common even as far south as 35°N. At 0000 on the 28th, the northward moving storm had a 949-millibar pressure and the **EUU6** near 52°N, 172°W was battling 15-meter seas in 50-knot westerlies. Fortunately the storm began to weaken and head into the Bering St. on the 29th.

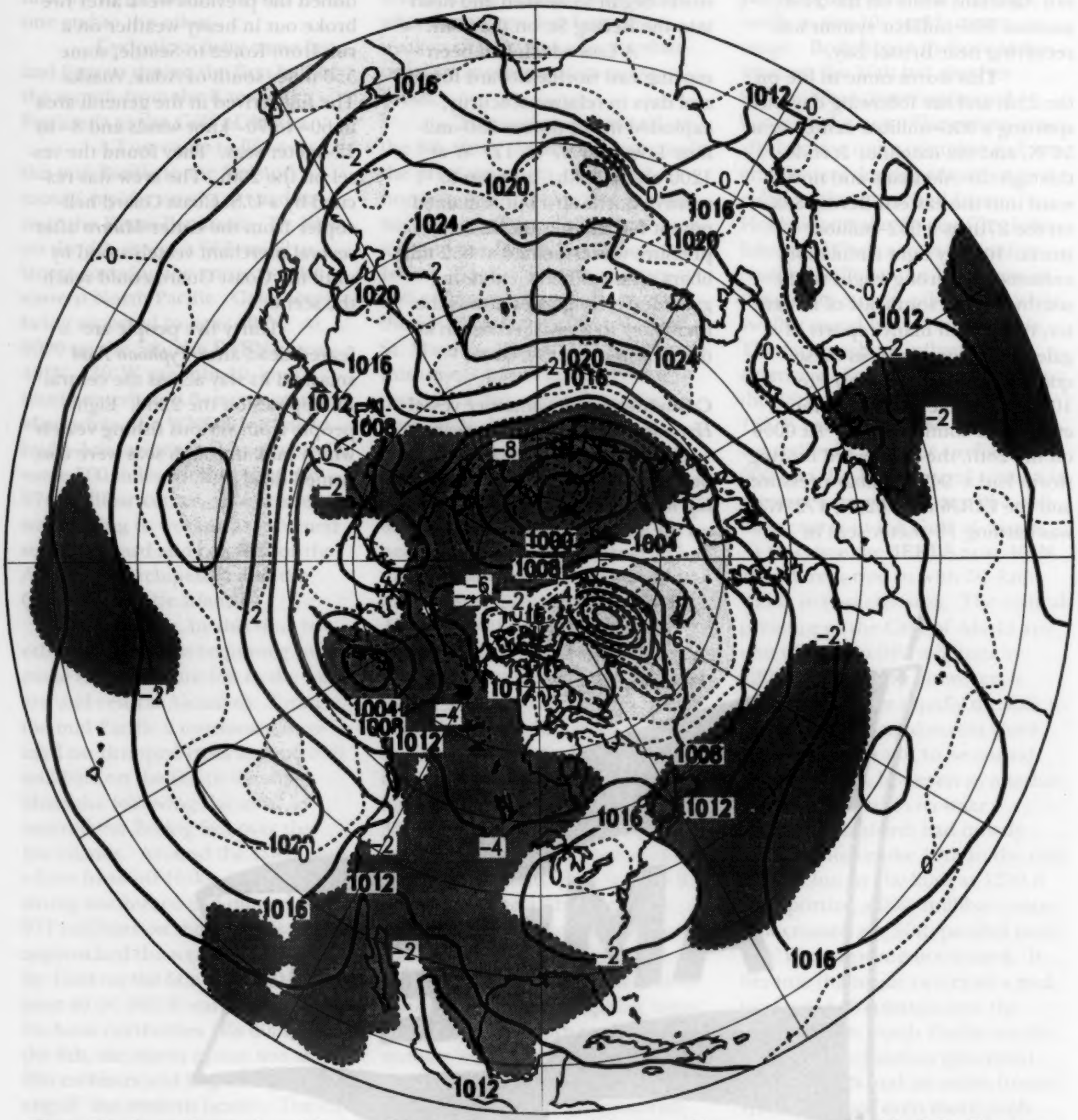
A Low which had been moving east northeastward for several days in relative obscurity, exploded into a potent 950-millibar Low near 47°N, 177°W at 1200 on the 29th. It began to recurve northward but remained potent for another day as central pressure was estimated at 952 millibars on the 30th. Generating gales and strong gales, it was the final blow to a ravished ocean as the month came to a close.

Casualties— The container vessel ***Hyundai Seattle*** drifted in severe weather for more than a week before the 40-meter tug ***Gene Dunlap*** headed out from Dutch Harbor on the 17th. The 260-meter ***Hyundai Seattle*** had been abandoned the previous week after fire broke out in heavy weather on a run from Korea to Seattle, some 550 miles south of Adak, Alaska. The tug arrived in the general area in 60- to 70- knot winds and 8- to 12-meter seas. They found the vessel on the 20th. The crew was rescued by a U.S. Coast Guard helicopter from the cutter ***Munro*** after several merchant vessels stood by until the Coast Guard could reach the scene.

Thirty five people are feared dead after ***Typhoon Axel*** smashed its way across the central Philippines on the 22nd. Eight people from various fishing vessels which sank in rough seas were confirmed dead.

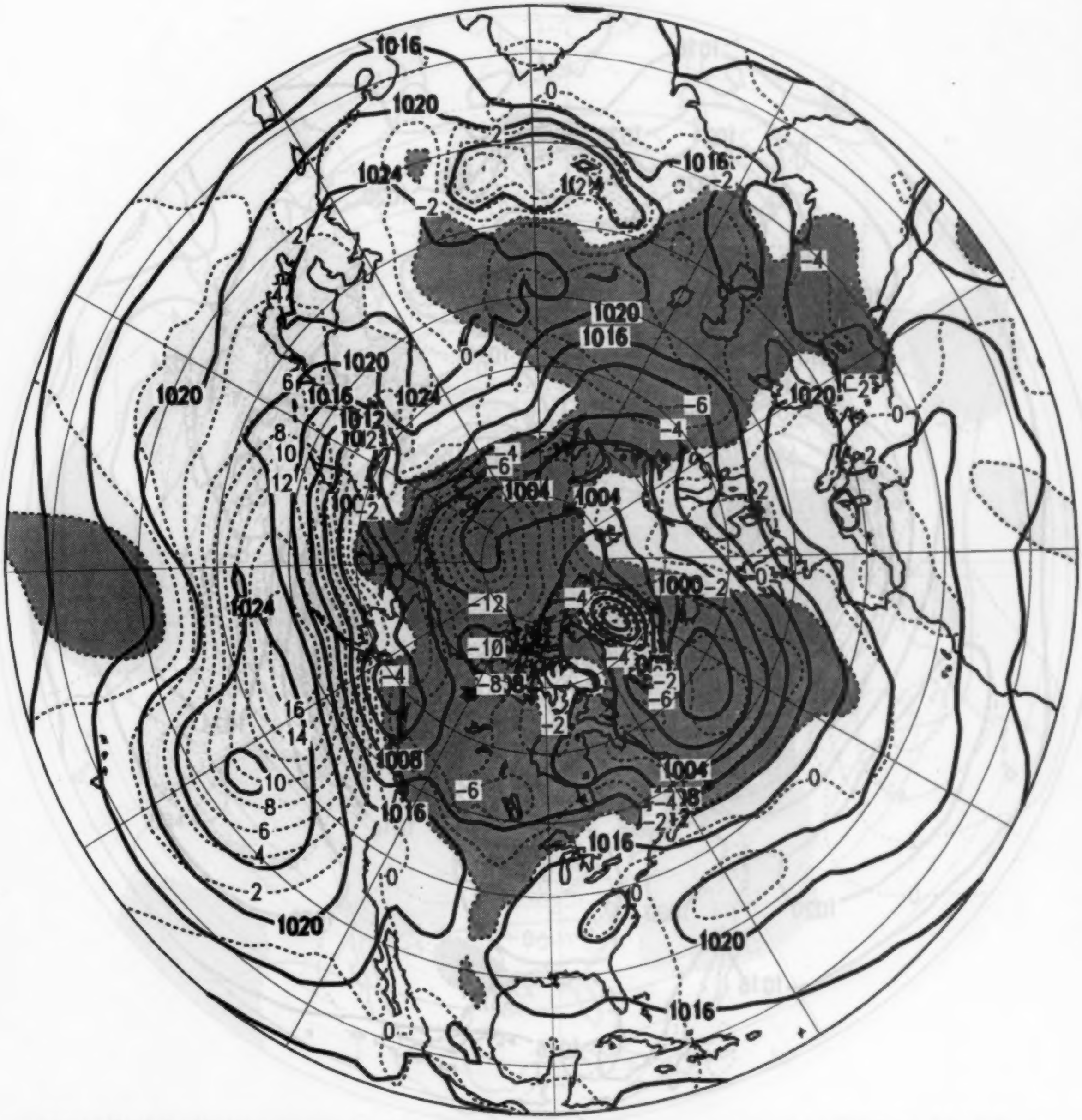
AMVER

October 1994



These Northern Hemisphere Mean and Anomalous Sea Level Pressure Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin. Mean values are denoted by solid contours drawn at intervals of 4 millibars. Anomalies (contour intervals of 2 millibars) are departures from the 1979–1988 base period monthly means. Negative anomalies of less than 2 millibars are indicated by the dark shading while positive anomalies of greater than 2 millibars are indicated by the light shading. The analysis should be treated with caution in regions of elevated terrain.

November 1994



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December 1994

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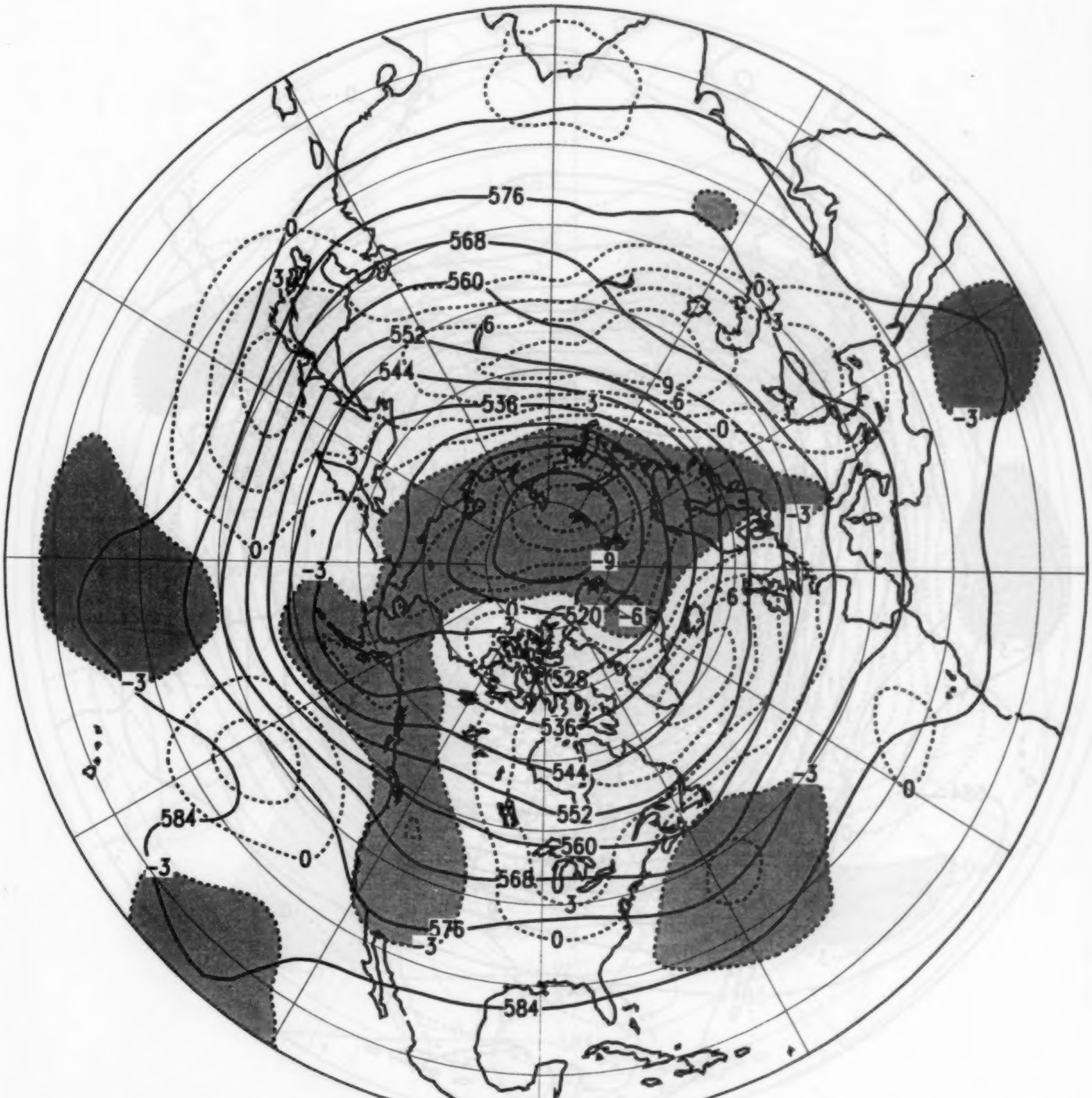
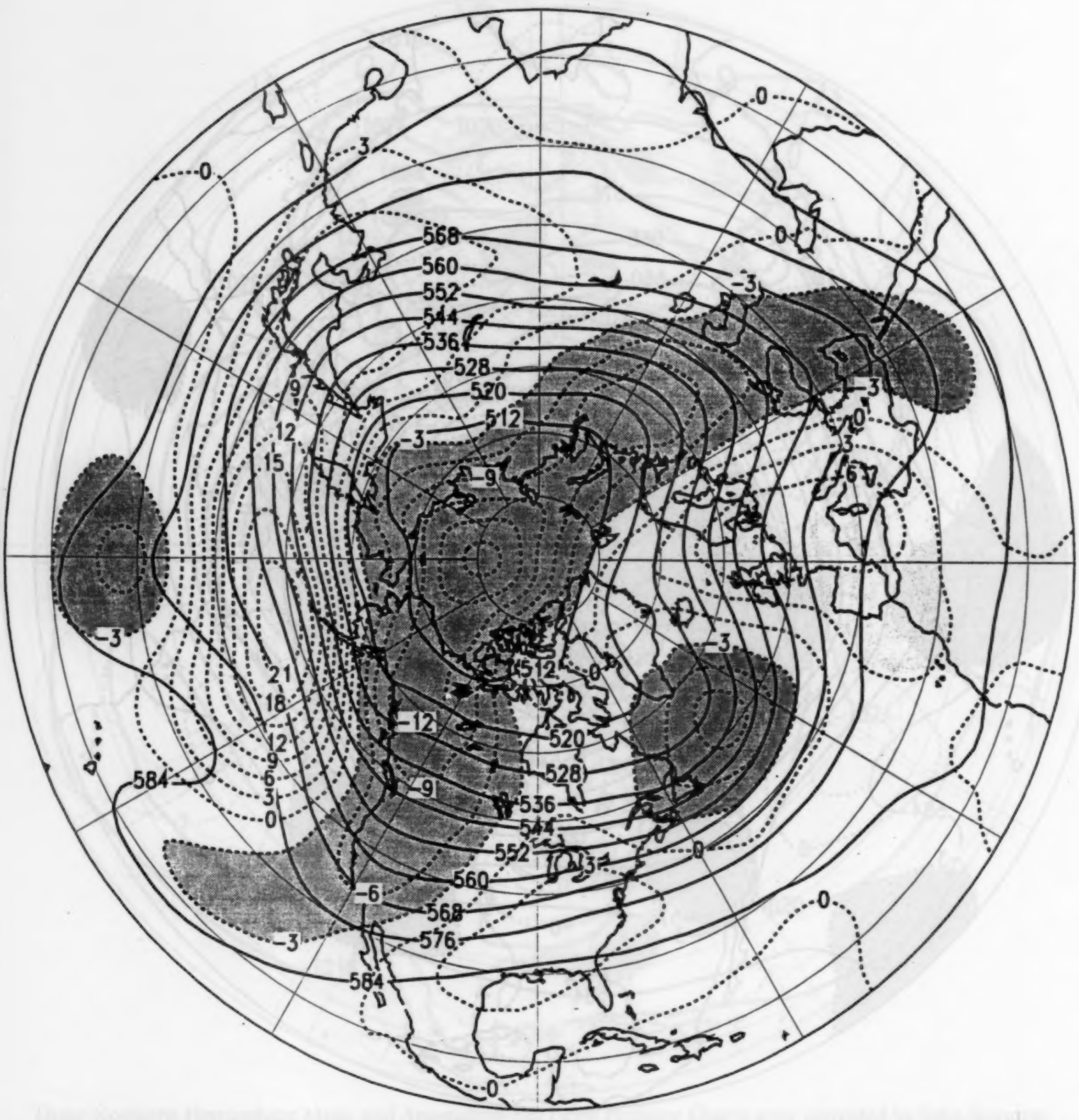
October 1994



These Northern Hemisphere Mean and Anomalous 500-millibar Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin. Mean geopotential values are denoted by solid contours drawn at intervals of 8 dynamic meters. Anomalies (contour intervals of 3 dynamic meters) are departures from the 1979-1988 base period monthly means. Negative anomalies of less than 3 dynamic meters are indicated by the dark shading while positive anomalies of greater than 3 dynamic meters are indicated by the light shading.

November 1994



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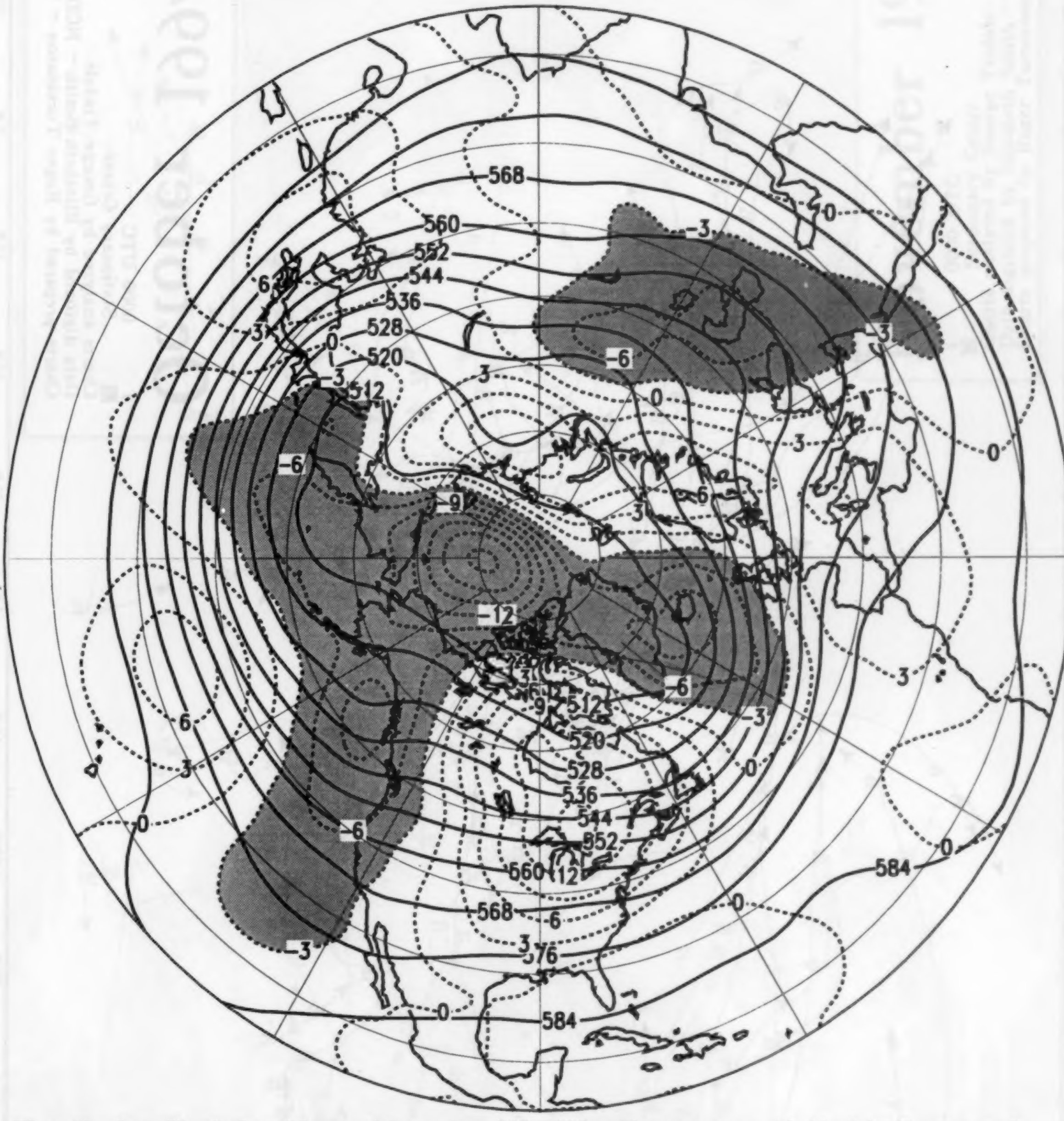
December 1994



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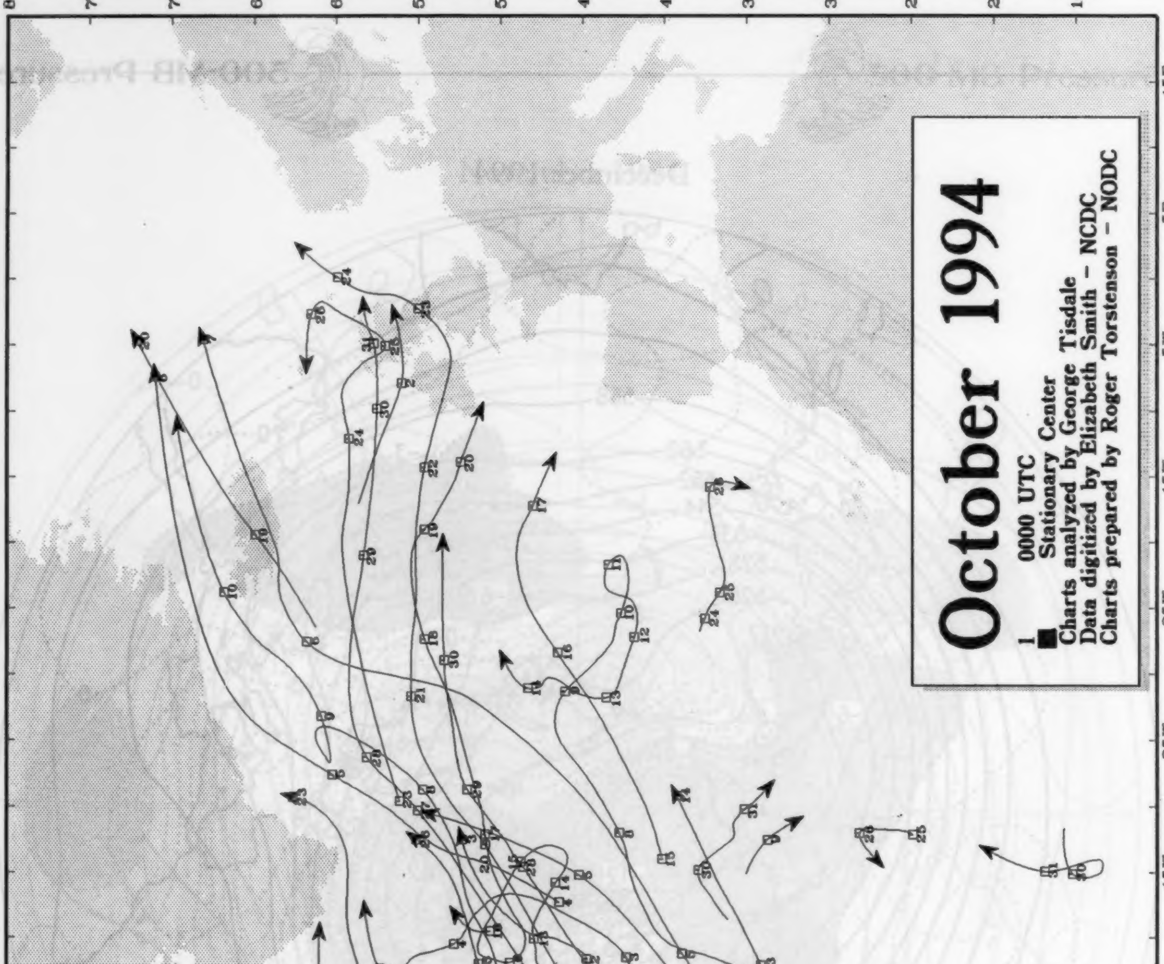
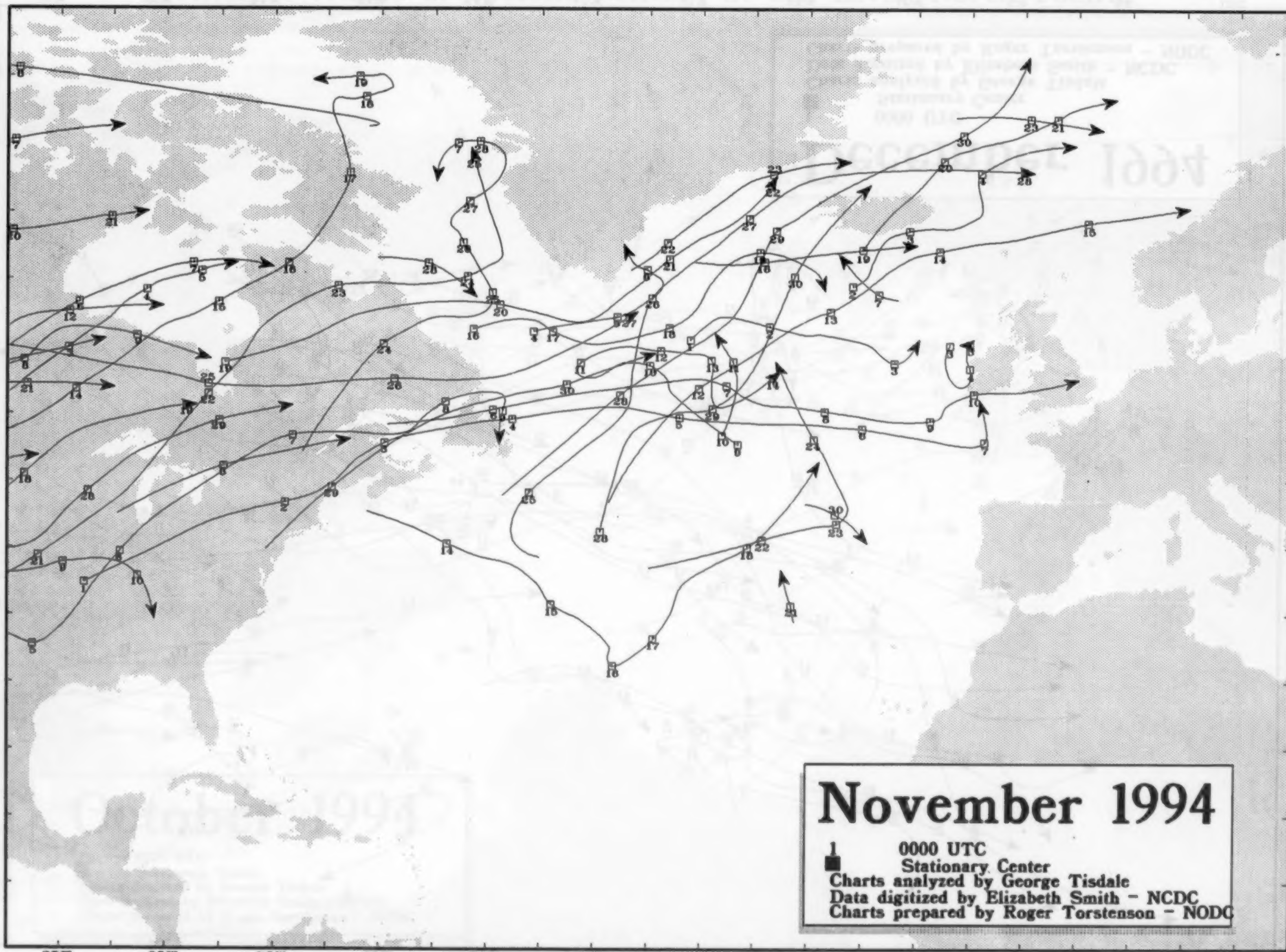
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



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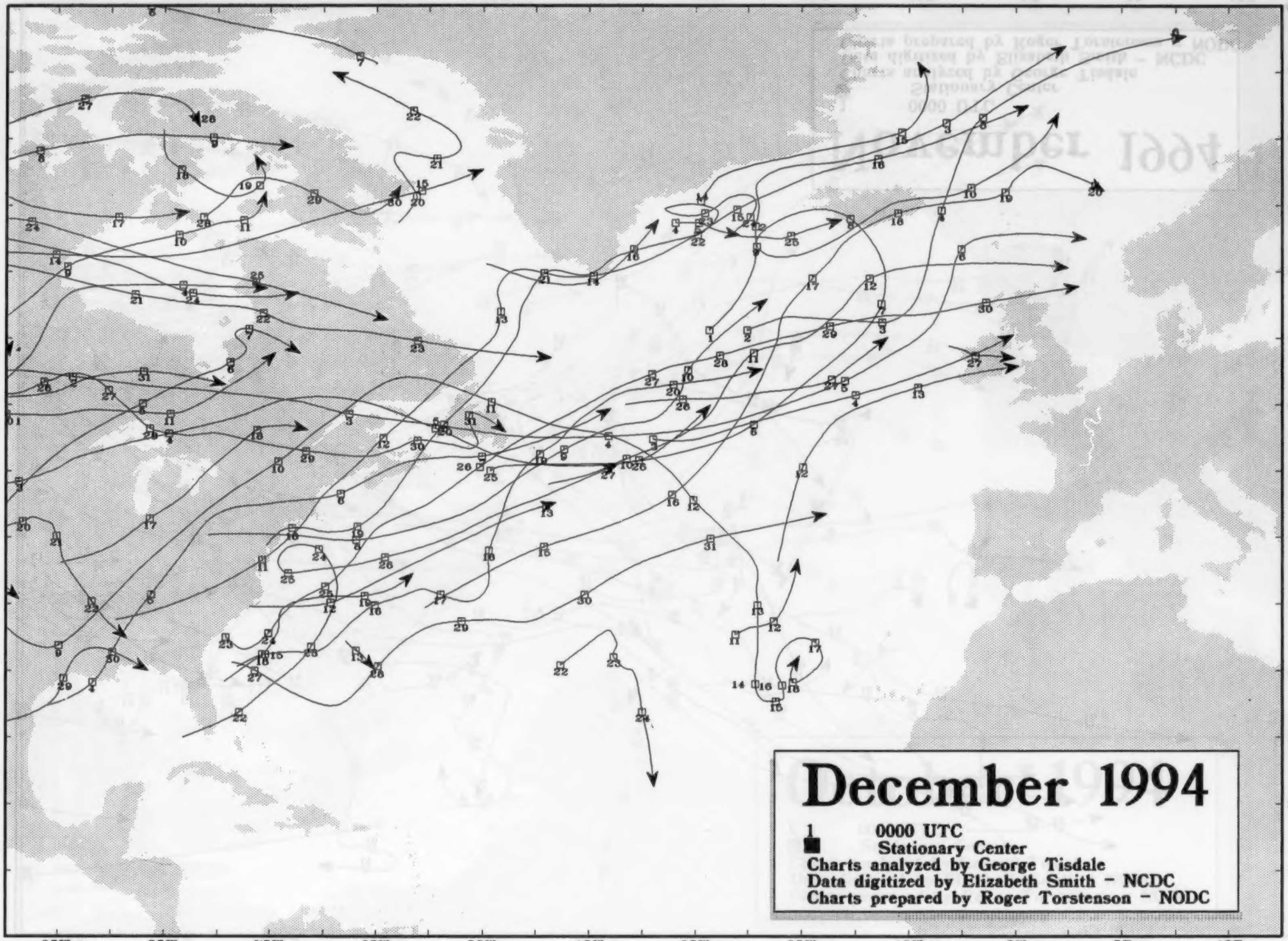
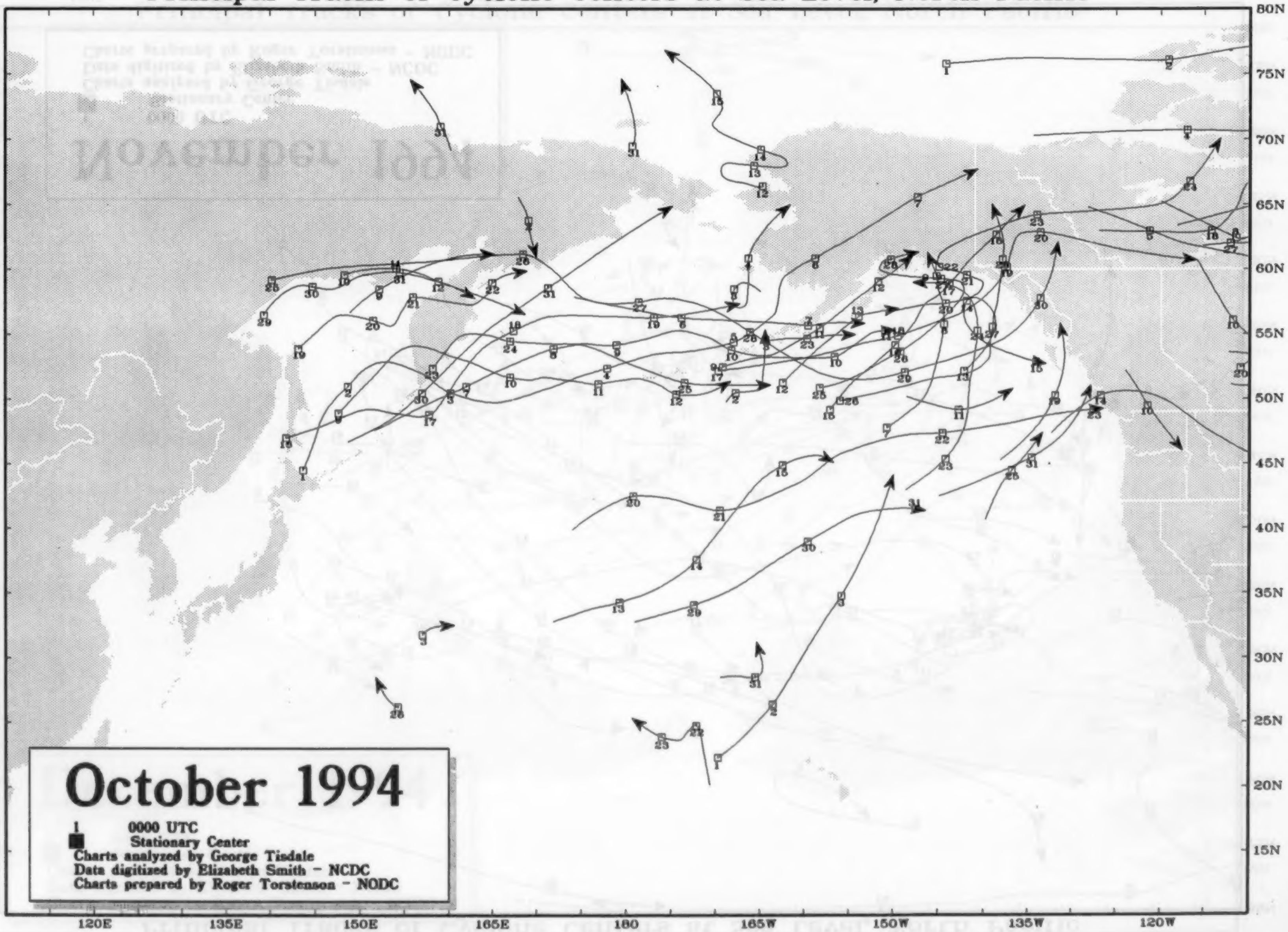
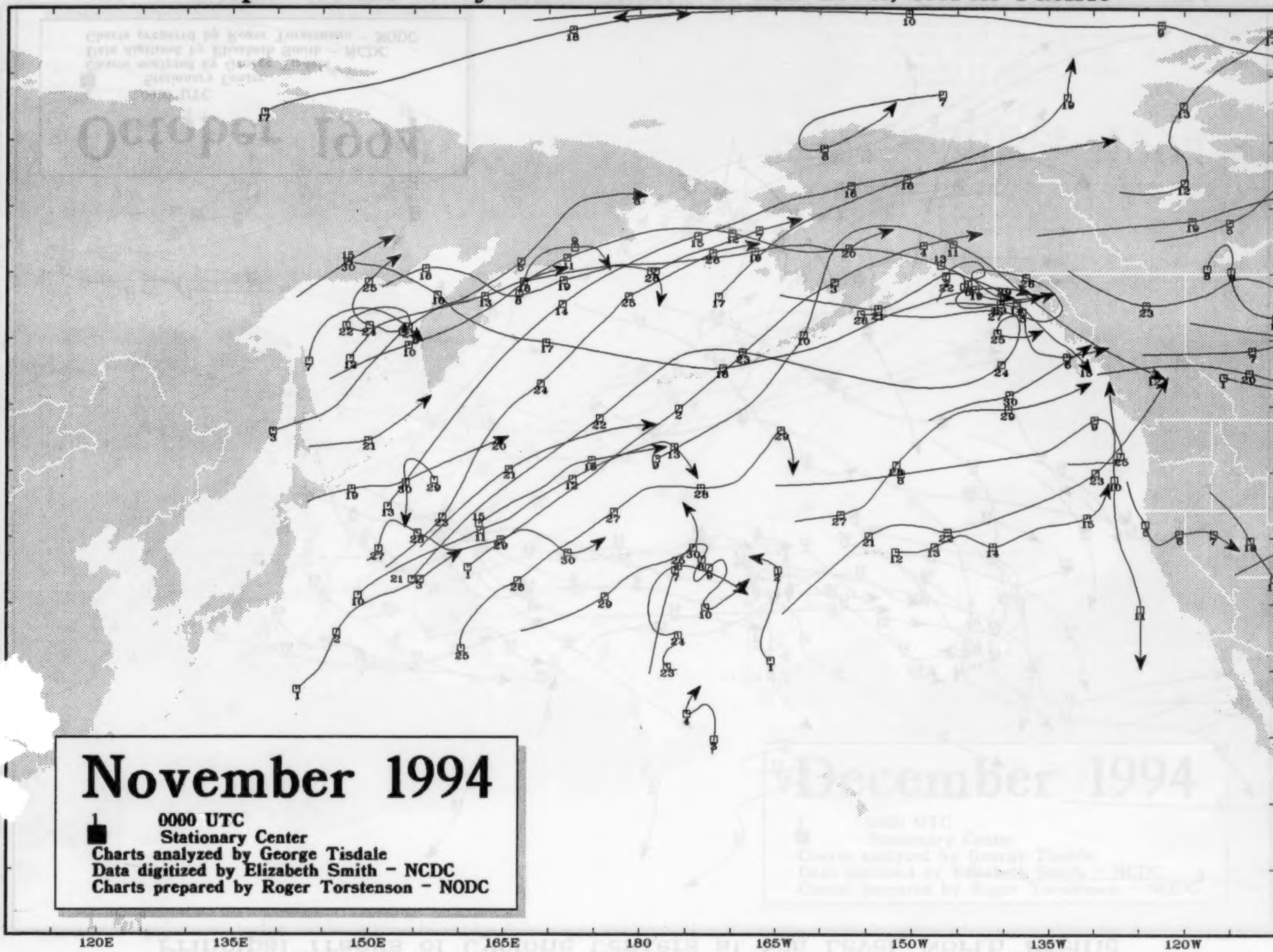


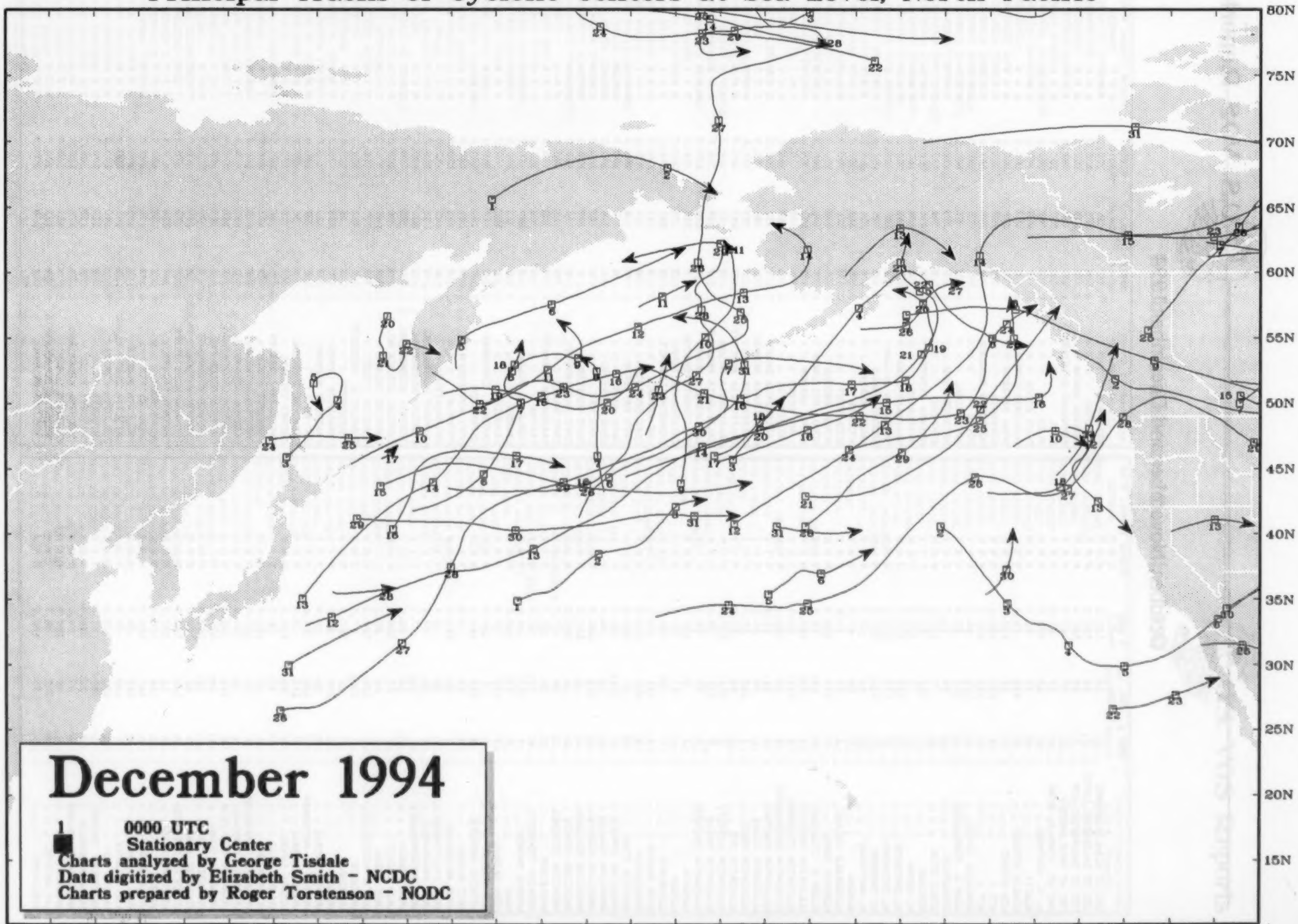
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



October, November and December 1994

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
1ST LT ALEX BONNYMAN	Y	16	100.0	N N N
1ST LT BALDOMERO LOPEZ	K	34	100.0	N N N
1ST LT BALDOMERO LOP	K	19	100.0	N N N
1ST LT JACK LUMMUS	Y	58	62.0	Y N Y
2ND LT. JOHN P. BOBO	N	32	50.0	Y N Y
A. V. KASTNER	K	42	100.0	N N N
ACACIA	B	73	91.7	Y Y N
ACADIA FOREST	O	284	15.4	Y Y Y
ACE ACCORD	S	32	100.0	N N N
ACT 7	J	152	100.0	N N N
ACT I	J	144	100.0	N N N
ADABELLE LYKES	O	155	44.5	Y Y Y
ADAM E. CORNELIUS	G	105	48.5	Y N Y
ADVANTAGE	N	64	21.8	Y Y Y
AFRIC STAR	B	1	100.0	N N N
AGULHAS	B	104	63.4	Y Y Y
AL AWDAH	U	1	100.0	N N N
AL SAMIDOON	U	138	100.0	N N N
AL SHUHADAA	U	177	100.0	N N N
AL TAHREER	U	223	100.0	N N N
AL WATTAYAH	B	58	0.0	Y Y Y
ALASKA	U	69	47.8	Y N Y
ALBEMARLE ISLAND	J	73	43.8	Y N Y
ALBERNI DAWN	U	174	100.0	N N N
ALDEN W. CLAUSEN	N	83	78.3	Y Y Y
ALLIGATOR AMERICA	S	63	100.0	N N N
ALLIGATOR COLUMBUS	S	111	51.3	Y N Y
ALLIGATOR EXCELLENCE	T	56	100.0	N N N
ALLIGATOR FORTUNE	S	55	96.3	Y Y Y
ALLIGATOR GLORY	S	96	65.6	Y N Y
ALLIGATOR HOPE	S	118	15.2	Y Y Y
ALLIGATOR JOY	S	81	93.8	Y Y Y
ALLIGATOR LIBERTY	S	201	100.0	N N N
ALLIGATOR PRIDE	F	237	39.6	Y Y Y
ALLIGATOR TRIUMPH	T	57	94.7	Y Y Y
ALMANIA	J	9	100.0	N N N
ALPENA	C	87	77.0	Y N Y
ALTAMONTE	T	70	65.7	Y Y Y
ALVA MAERSK	S	161	69.5	Y N Y
AMBASSADOR	B	152	100.0	N N N
AMERICA STAR	U	97	100.0	N N N
AMERICAN CONDOR	J	171	54.9	Y Y Y
AMERICAN FALCON	K	56	96.4	Y Y Y
AMERICAN KESTREL	K	119	100.0	N N N
AMERICAN MARINER	C	8	100.0	N N N
AMERICAN OSPREY	N	8	100.0	N N N
AMERICAN VETERAN	O	96	57.2	Y Y Y
AMERICANA	N	51	80.3	Y Y Y
AMERIGO VESPUCCI	N	78	52.5	Y N Y
ANDERS MAERSK	T	217	56.6	Y N Y
ANNA	K	73	100.0	N N N
ANNA MAERSK	T	154	72.7	Y N Y
APJ SHALIN	T	1	100.0	N N N
ARABIAN SENATOR	N	242	100.0	N N N
ARCO ALASKA	T	45	0.0	Y Y Y
ARCO ANCHORAGE	T	23	100.0	N N N
ARCO CALIFORNIA	T	86	2.3	Y Y Y
ARCO FAIRBANKS	T	35	77.1	Y N Y
ARCO INDEPENDENCE	T	56	7.1	Y Y Y
ARCO JUNEAU	T	13	84.6	Y N Y
ARCO SPIRIT	T	15	100.0	N N N
ARCO TEXAS	T	65	26.1	Y Y Y
ARCTIC UNIVERSAL	B	121	100.0	N N N
ARGONAUT	J	135	17.0	Y N Y
ARIZONA	K	23	100.0	N N N
ARMCO	C	200	69.5	Y Y Y
ARNOLD MAERSK	J	85	32.9	Y N Y
ARTHUR M. ANDERSON	G	221	57.0	Y Y Y
ARTHUR MAERSK	T	174	2.2	Y N Y
ASHLEY LYKES	O	50	100.0	N N N
ATIGUN PASS	T	45	75.5	Y Y Y
ATLANTA BAY	U	12	100.0	N N N
ATLANTIC COMPANION	J	58	100.0	N N N
ATLANTIC COMPASS	N	66	100.0	N N N
ATLANTIC CONVEYOR	N	124	100.0	N N N
ATLANTIC HURON	B	19	100.0	N N N
ATLANTIC OCEAN	J	52	100.0	N N N
ATLANTIC STAR	B	41	100.0	N N N
ATLANTIC SUPERIOR	B	142	100.0	N N N
AUCKLAND STAR	B	11	100.0	N N N
AUTHOR	U	128	100.0	N N N
AVILA STAR	B	100	100.0	N N N
AXEL MAERSK	F	218	54.5	Y N Y
B.T. ALASKA	T	150	44.6	Y N Y
BALTIC SUN	B	131	100.0	N N N
BALTIMORE TRADER	U	80	51.2	Y Y Y
BARBARA ANDRIE	G	16	100.0	N N N
BARRINGTON ISLAND	J	77	79.2	Y N Y
BAUCHI	M	66	100.0	N N N
BAY BRIDGE	S	202	40.5	Y Y Y
BEBEDOURO	J	79	100.0	N N N

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
BELGRANO	U	35	100.0	N N N
BELLONA	K	163	100.0	N N N
BERGEN ARROW	B	69	100.0	N N N
BERNARDO QUINTANA A	O	87	81.6	Y Y Y
BIBI	U	107	100.0	N N N
BLED	S	43	100.0	N N N
BLUE RIDGE	F	158	67.0	Y N Y
BOGASARI LIMA	S	163	100.0	N N N
BONN EXPRESS	U	115	100.0	N N N
BORINGIA	N	367	23.7	Y N Y
BOSPORUS BRIDGE	F	295	63.0	Y Y Y
BOVEC	T	16	100.0	N N N
BP ADMIRAL	U	55	100.0	N N N
BP ADVENTURE	S	116	100.0	N N N
BRAVERY	F	74	33.7	Y Y Y
BREMEN EXPRESS	N	76	100.0	N N N
BRIDGETON	U	34	100.0	N N N
BRISBANE STAR	S	231	100.0	N N N
BROOKLYN BRIDGE	F	230	69.5	Y Y Y
BROOKS RANGE	T	35	51.4	Y Y Y
BRUCE SMART	F	204	5.3	Y Y Y
BUCKEYE	C	262	87.0	Y Y Y
BUDAPESHT	U	26	100.0	N N N
BUNGA KANTAN	T	6	100.0	N N N
BUNGA KESIDANG	T	2	100.0	N N N
BURNS HARBOR	G	503	55.8	Y Y Y
C.W. KITTO	U	10	0.0	Y N Y
CALCITE II	G	118	85.5	Y Y Y
CALIFORNIA CERES	T	32	100.0	N N N
CALIFORNIA HERMES	S	86	81.3	Y Y Y
CALIFORNIA LUNA	S	17	100.0	N N N
CALIFORNIA MERCURY	S	197	100.0	N N N
CALIFORNIA ORION	T	91	74.7	Y Y Y
CALIFORNIA PEGASUS	F	78	100.0	N N N
CALIFORNIA STAR	T	110	100.0	N N N
CALIFORNIA TRITON	T	135	58.5	Y Y Y
CALIFORNIA ZEUS	S	39	100.0	N N N
CANADIAN LIBERTY	B	201	64.1	Y Y Y
CAP PALMAS	B	17	100.0	N N N
CAPE DECISION	N	32	0.0	Y N Y
CAPE HATTERAS	O	4	100.0	N N N
CAPE HORN	N	3	100.0	N N N
CAPE INTREPID	U	6	100.0	N N N
CAPE MAY	N	43	100.0	N N N
CAPE MOHICAN	F	7	100.0	N N N
CAPE WASHINGTON	B	14	100.0	N N N
CAPE WRATH	B	11	100.0	N N N
CARIBBEAN EMERALD	T	90	38.8	Y Y Y
CARINA	T	68	51.4	Y Y N
CARLA A. HILLS	F	149	86.5	Y N Y
CARMEL	T	22	100.0	N N N
CAROLINA	K	116	62.0	Y N N
CASON J. CALLAWAY	G	317	68.4	Y N Y
CAVENDISH	U	134	100.0	N N N
CCNI ANTARTICO	M	41	100.0	N N N
CEDRELA	S	39	100.0	N N N
CELEBRATION	M	42	52.3	Y Y N
CENTURY HIGHWAY #2	T	183	100.0	N N N
CENTURY HIGHWAY NO. 5	K	222	100.0	N N N
CENTURY HIGHWAY NO. 3	U	95	100.0	N N N
CENTURY LEADER NO. 1	U	86	100.0	N N N
CHARLES ISLAND	M	65	3.0	Y N N
CHARLES LYKES	B	117	76.9	Y Y N
CHARLES M. BEEGHLEY	C	52	65.3	Y Y Y
CHARLESTON	J	6	100.0	N N N
CHARLOTTE LYKES	U	235	35.7	Y Y Y
CHASTINE MAERSK	J	30	0.0	Y Y N
CHC NO.1	S	57	100.0	N N N
CHEMICAL PIONEER	U	96	97.9	Y N Y
CHERRY VALLEY	T	10	70.0	Y N Y
CHESAPEAKE TRADER	U	56	100.0	N N N
CHESTNUT HILL	N	122	36.8	Y Y N
CHEVRON ANTWERP	F	3	100.0	N N N
CHEVRON ATLANTIC	O	251	0.0	Y Y N
CHEVRON CALIFORNIA	F	146	76.0	Y Y Y
CHEVRON COLORADO	F	82	97.5	Y N Y
CHEVRON EDINBURGH	F	79	100.0	N N N
CHEVRON EMPLOYEE PRIDE	B	170	0.0	Y Y N
CHEVRON MISSISSIPPI	F	72	76.3	Y Y Y
CHEVRON PACIFIC	F	218	1.3	Y Y Y
CHINA HOPE	S	37	100.0	N N N
CHINA SPIRIT	S	4	100.0	N N N
CHIQUITA BELGIE	B	135	100.0	N N N
CHIQUITA DEUTSCHLAND	B	151	100.0	N N N
CHIQUITA ITALIA	B	140	100.0	N N N
CHIQUITA JEAN	K	119	100.0	N N N
CHIQUITA KING	K	118	66.1	Y N Y
CHIQUITA NEDERLAND	B	175	100.0	N N N
CHIQUITA QUEEN	K	161	100.0	N N N
CHIQUITA SCANDINAVIA	B	153	100.0	N N N
CHIQUITA SCHWEIZ	B	159	100.0	N N N

October, November and December 1994

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
CIELO DI FIRENZE	T	80	38.7	Y N Y
CLEMENTINA	T	4	100.0	N N N
CLEVELAND	U	12	100.0	N N N
CLIFFORD MAERSK	J	28	96.4	Y N Y
COAST RANGE	F	68	82.3	Y Y Y
COASTAL EAGLE POINT	U	4	100.0	N N N
COASTAL MANATEE	K	39	61.5	Y N N
COLORADO	M	114	73.6	Y N Y
COLUMBIA BAY	U	80	100.0	N N N
COLUMBIA STAR	T	364	89.5	Y Y Y
COLUMBUS AMERICA	N	49	100.0	N N N
COLUMBUS AUSTRALIA	U	79	100.0	N N N
COLUMBUS CALIFORNIA	T	217	100.0	N N N
COLUMBUS CANADA	S	656	72.2	Y N N
COLUMBUS NEW ZEALAND	J	95	100.0	N N N
COLUMBUS OLIVOS	N	70	70.0	Y Y Y
COLUMBUS QUEENSLAND	N	108	100.0	N N N
COLUMBUS VICTORIA	T	149	100.0	N N N
COLUMBUS WELLINGTON	S	60	100.0	N N N
CONCERT EXPRESS	N	39	100.0	N N N
CONDOLEEZZA RICE	B	80	5.0	Y Y N
CONTIENTAL WING	T	126	100.0	N N N
CONTSHIP ENGLAND	U	37	100.0	N N N
CORAH ANN	U	144	34.0	Y Y Y
CORNELIA MAERSK	N	164	80.4	Y N N
CORNELIS VEROLME	B	24	100.0	N N N
CORNUCOPIA	F	110	46.3	Y Y N
CORONADO	K	17	70.5	Y N N
CORPUS CHRISTI	U	26	100.0	N N N
COURIER	U	44	100.0	N N N
COURTNEY BURTON	C	158	81.6	Y Y Y
COURTNEY L.	B	227	38.7	Y Y Y
CPL. LOUIS J. HAUGE	N	10	100.0	N N N
CRIMMITSCHAU	U	19	100.0	N N N
CRISTOFORO COLOMBO	N	71	59.1	Y Y N
CROWN JEWEL	M	105	0.0	Y Y N
CROWN PRINCESS	M	2	100.0	N N N
CSL ATLAS	B	81	100.0	N N N
CSS HUDSON	N	127	100.0	N N N
DAN MOORE	N	1	100.0	N N N
DEL MONTE CONSUMER	B	120	67.5	Y Y N
DEL MONTE PACKER	K	6	100.0	N N N
DEL MONTE TRADER	B	28	50.0	Y Y N
DELAWARE TRADER	T	114	78.9	Y Y N
DELMONTE PLANTER	M	92	0.0	Y Y Y
DELMONTE TRANSPORTER	M	53	90.5	Y Y Y
DENALI	T	186	100.0	N N N
DIRECT EAGLE	T	120	71.6	Y Y N
DIRECT KIWI	T	107	100.0	N N N
DIRECT KOOKABURRA	T	75	100.0	N N N
DMITRIY OLYANOV	U	5	100.0	N N N
DOCTOR LYKES	B	116	100.0	N N N
DOLE COSTA RICA	M	4	100.0	N N N
DOROTHEA OLDENDORFF	S	92	90.2	Y Y N
DOUBLE GLORY	J	30	100.0	N N N
DSR BALTIC	N	150	100.0	N N N
DSR EUROPE	N	128	100.0	N N N
DSR PACIFIC	T	117	100.0	N N N
DUCHESS	J	4	100.0	N N N
DUSSELDORF EXPRESS	J	1061	100.0	N N N
DYVI BALTIC	M	3	100.0	N N N
DYVI OCEANIC	K	69	100.0	N N N
EASTERN LION	T	89	100.0	N N N
ECSTASY	M	24	91.6	Y N Y
EDELWIESS	S	141	100.0	N N N
EDGAR B. SPEER	G	158	74.0	Y Y Y
EDINBURGH FRUID	U	81	100.0	N N N
EDWIN H. GOTT	G	394	62.4	Y Y Y
EDWIN LINK	M	47	0.0	Y N N
EDYTH L.	B	71	97.1	Y Y Y
EIBE OLDENDORFF	S	230	83.0	Y Y Y
ELENORE	M	8	100.0	N N N
ELIZABETH LYKES	O	28	100.0	N N N
ELLEN HUDIG	B	40	100.0	N N N
ELLEN KNUDSEN	N	46	100.0	N N N
ELLENSBORG	M	34	0.0	Y N N
ELSBORG	M	99	0.0	Y Y Y
EMMA OLDENDORFF	S	55	100.0	N N N
ENCHANTED SEAS	O	43	90.6	Y Y Y
ENDEAVOR 2	S	152	41.4	Y N Y
ENTERPRISE	B	108	100.0	N N N
EUROPEAN SENATOR	N	89	100.0	N N N
EVER GAINING	N	26	84.6	Y Y N
EVER GALLANT	N	8	100.0	N N N
EVER GARDEN	N	14	100.0	N N N
EVER GARLAND	T	33	100.0	N N N
EVER GATHER	J	15	100.0	N N N
EVER GENTLE	J	6	100.0	N N N
EVER GENTRY	J	39	0.0	Y N N
EVER GIANT	T	8	100.0	N N N
EVER GIVEN	T	4	100.0	N N N
EVER GLAMOUR	T	11	100.0	N N N

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
EVER GLEAMY	J	4	100.0	N N N
EVER GLEEFUL	T	18	100.0	N N N
EVER GLOBE	N	12	100.0	N N N
EVER GLORY	J	7	100.0	N N N
EVER GOLDEN	B	18	100.0	N N N
EVER GOODS	J	14	100.0	N N N
EVER GOVERN	T	36	100.0	N N N
EVER GRADE	J	13	100.0	N N N
EVER GROUP	T	13	100.0	N N N
EVER GUARD	S	5	100.0	N N N
EVER GUIDE	T	1	100.0	N N N
EVER LAUREL	T	18	100.0	N N N
EVER LIVING	S	3	100.0	N N N
EVER LOADING	J	6	100.0	N N N
EVER LYRIC	T	6	100.0	N N N
EVER RACER	N	48	0.0	Y N Y
EVER RENOWN	T	26	92.3	Y N Y
EVER ROUND	T	12	100.0	N N N
EXPORT FREEDOM	J	61	52.4	Y N Y
EXPORT PATRIOT	J	152	44.0	Y Y Y
FAIRLIFT	N	44	100.0	N N N
FAIRMAST	N	90	100.0	N N N
FALSTRIA	S	76	100.0	N N N
FANTASY	M	7	71.4	Y N N
FARALLON ISLAND	F	374	100.0	N N N
FASINATION	M	191	48.6	Y N Y
FAUST	K	152	51.3	Y Y Y
FEDERAL SKEENA	O	72	55.5	Y Y Y
FERNCROFT	T	159	83.6	Y Y N
FESTIVALE	M	77	35.0	Y N Y
FETISH	N	88	93.1	Y N N
FIDELIO	K	76	100.0	N N N
FIR GROVE	S	113	47.7	Y N N
FOREST HAWK	J	83	24.0	Y Y Y
FRANCES HAMMER	K	78	100.0	N N N
FRANCES L.	B	177	72.8	Y Y Y
FRED G.	O	28	100.0	N N N
FRED R. WHITE JR	C	140	70.0	Y N Y
FREDERICKSBURG	U	55	100.0	N N N
FREJA SVEA	Y	7	100.0	N N N
FRINES	U	2	100.0	N N N
GALVESTON BAY	K	169	87.5	Y Y Y
GEM STATE	T	37	100.0	N N N
GENEVIEVE LYKES	O	37	100.0	N N N
GEORGE A. SLOAN	G	64	100.0	N N N
GEORGE A. STINSON	C	65	69.2	Y Y Y
GEORGE H. WEYERHAEUSER	F	6	100.0	N N N
GEORGE SCHULTZ	B	45	100.0	N N N
GEORGE WASHINGTON BRID	T	210	97.9	N N N
GEORGIA RAINBOW II	K	195	51.7	Y N N
GINA MARU	T	129	100.0	N N N
GLOBAL LINK	B	26	96.1	Y N Y
GLOBAL SENTINEL	B	69	100.0	N N N
GOLDEN APO	S	33	81.8	Y Y Y
GOLDEN GATE	T	3	100.0	N N N
GOLDEN GATE BRIDGE	S	289	83.0	Y Y Y
GOLDEN MONARCH	K	41	100.0	N N N
GOPHER STATE	N	142	33.0	Y Y N
GREAT LAND	S	199	58.7	Y Y N
GREEN BAY	T	43	100.0	N N N
GREEN HARBOUR	O	19	26.3	Y N Y
GREEN ISLAND	O	54	35.1	Y N N
GREEN LAKE	B	176	50.0	Y Y Y
GREEN MAYA	S	201	26.3	Y N Y
GREEN RIDGE	S	47	2.1	Y N N
GREEN SASEBO	S	47	100.0	N N N
GREEN SUMA	S	12	100.0	N N N
GREEN SYLVAN	S	34	100.0	N N N
GREEN VALLEY	U	4	100.0	N N N
GREEN WAVE	Y	56	39.2	Y Y N
GROWTH RING	S	123	100.0	N N N
GUAYAMA	K	43	100.0	N N N
GULF CURRENT	U	59	55.9	Y N N
GULF SPIRIT	U	157	100.0	N N N
GULL ARROW	B	49	100.0	N N N
GYPSUM BARON	M	159	100.0	N N N
GYPSUM KING	M	145	100.0	N N N
H. LEE WHITE	C	25	68.0	Y Y N
HANJIN BARCELONA	T	34	100.0	N N N
HANJIN BREMEN	S	16	100.0	N N N
HANJIN CHUNGMU	S	67	100.0	N N N
HANJIN ELIZABETH	F	19	100.0	N N N
HANJIN FELIXSTOWE	S	12	100.0	N N N
HANJIN HAMBURG	T	14	100.0	N N N
HANJIN HONG KONG	T	12	100.0	N N N
HANJIN KOBE	T	39	100.0	N N N
HANJIN LE HAVRE	S	11	100.0	N N N
HANJIN LONG BEACH	T	4	100.0	N N N
HANJIN MARSEILLES	F	43	100.0	N N N
HANJIN NEW YORK	T	13	100.0	N N N
HANJIN OAKLAND	T	14	100.0	N N N

October, November and December 1994

	FMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
HANJIN ROTTERDAM	S	12	100.0	N N N
HANJIN SAVANNAH	T	2	100.0	N N N
HANJIN SEATTLE	S	11	100.0	N N N
HANJIN TONGHAE	S	28	100.0	N N N
HANJIN VANCOUVER	T	17	100.0	N N N
HANJIN YOKOHAMA	T	62	100.0	N N N
HANSA LUBECK	T	16	100.0	N N N
HANSA VISBY	T	11	100.0	N N N
HARMONY ACE	K	1	100.0	N N N
HAVJO	M	46	60.8	Y N N
HEIDELBERG EXPRESS	U	87	100.0	N N N
HEIJIN	K	15	100.0	N N N
HENRY HUDSON BRIDGE	T	180	100.0	N N N
HERBERT C. JACKSON	C	147	76.1	Y Y Y
HERMOD	U	58	100.0	N N N
HESIOD	U	178	100.0	N N N
HIBISCUS II	B	219	10.9	Y Y N
HOEGH CAIRN	B	31	100.0	N N N
HOEGH CLIPPER	S	13	100.0	N N N
HOEGH DRAKE	N	18	11.1	Y Y N
HOEGH DUKE	N	14	100.0	N N N
HOEGH DYKE	T	59	45.7	Y N N
HOEGH MERCHANT	S	27	14.8	Y N N
HOEGH MINERVA	S	7	100.0	N N N
HOLIDAY	M	95	40.0	Y Y Y
HOWELL LYKES	S	103	33.0	Y Y Y
HUAL ANGELITA	K	4	100.0	N N N
HUAL INGRITA	K	57	[illegible]	Y Y N
HUAL ROLITA	K	21	71.4	Y Y N
HUMACAO	N	96	55.2	Y Y N
HYUNDAI CONTINENTAL	N	14	100.0	N N N
HYUNDAI DUKE	T	29	100.0	N N N
HYUNDAI EMPERIOR	T	29	100.0	N N N
HYUNDAI PORTLAND	S	51	100.0	N N N
HYUNDAI VANCOUVER	S	52	100.0	N N N
INDIAN GOODWILL	O	10	100.0	N N N
INDIAN OCEAN	J	113	71.6	Y Y N
INDIANA HARBOR	C	110	88.1	Y Y N
INFANTA	U	42	100.0	N N N
INGER	U	78	41.0	Y N N
IOWA TRADER	U	49	100.0	N N N
ISLA GRAN MALVINA	J	2	100.0	N N N
ISLAND PRINCESS	T	27	100.0	N N N
ITB BALTIMORE	J	79	74.6	Y Y Y
ITB GROTON	J	191	73.8	Y Y Y
ITB JACKSONVILLE	B	151	94.7	Y Y N
ITB MOBILE	J	46	100.0	N N N
ITB NEW YORK	J	59	100.0	N N N
ITB PHILADELPHIA	B	3	100.0	N N N
IVER EXPRESS	U	34	100.0	N N N
J. DENNIS BONNEY	B	99	3.0	Y N Y
JAHRE SPIRIT	U	1	100.0	N N N
JALAGOVIND	O	3	100.0	N N N
JALAVIHAR	B	1	100.0	N N N
JALISCO	U	153	62.0	Y Y Y
JAMES LYKES	O	178	46.6	Y Y Y
JAMES N. SULLIVAN	B	72	0.0	Y Y N
JAMES R. BARKER	C	130	80.7	Y Y Y
JAPAN RAINBOW 2	S	162	47.5	Y Y Y
JAPAN SENATOR	N	11	100.0	N N N
JASMINE	U	164	100.0	N N N
JEAN LYKES	U	70	82.8	Y Y N
JEB STUART	F	60	100.0	N N N
JEBEL ALI	J	100	58.0	Y N Y
JO CLIPPER	B	123	100.0	N N N
JOHN G. MUNSON	G	241	55.1	Y Y Y
JOHN J. BOLAND	C	128	96.0	Y Y N
JOHN LYKES	U	51	100.0	N N N
JOHN YOUNG	F	166	0.0	Y Y Y
JOSEPH H. FRANTZ	C	235	85.5	Y N Y
JOSEPH L. BLOCK	G	52	86.5	Y Y Y
JOSEPH LYKES	B	171	49.1	Y N N
JUBILANT	K	31	77.4	Y N N
JUBILEE	T	36	77.7	Y N Y
JULIUS HAMMER	K	103	95.1	Y Y N
JUPITER DIAMOND	B	44	100.0	N N N
KAHO	G	30	0.0	Y N N
KAIMOKU	T	190	97.3	Y Y Y
KAINALU	T	231	62.3	Y Y Y
KAKUSHIMA	S	86	100.0	N N N
KANSAS TRADER	U	112	48.2	Y Y Y
KAPITAN BOCHEK	U	2	100.0	N N N
KAREN ANDRIE	G	37	83.7	Y Y N
KAUAI	F	197	51.7	Y Y Y
KAYE E. BARKER	C	256	89.4	Y Y Y
KAZIMAH	U	143	100.0	N N N
KEISHO MARU	S	28	100.0	N N N
KENAI	U	189	65.0	Y Y Y
KENNETH E. HILL	J	131	55.7	Y Y Y
KENNETH T. DERR	J	64	100.0	N N N
KENTUCKY HIGHWAY	N	70	100.0	N N N

	FMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
KEYSTONE CANYON	T	56	92.8	Y Y N
KINSMAN ENTERPRISE	C	8	75.0	Y N Y
KINSMAN INDEPENDENT	C	134	26.8	Y N Y
KITTANING	N	26	100.0	N N N
KOLN EXPRESS	J	377	100.0	N N N
KOPER EXPRESS	N	3	100.0	N N N
KURE	S	92	39.1	Y Y N
LA TRINITY	O	58	65.5	Y Y Y
LAKE GUARDIAN	G	33	100.0	N N N
LASH ATLANTICO	O	55	89.0	Y Y Y
LAWRENCE H. GIANELLA	N	23	100.0	N N N
LEE A. TREGURTHA	C	7	0.0	Y Y Y
LEON	B	15	100.0	N N N
LEONARD J. COWLEY	N	80	100.0	N N N
LEONIA	U	150	100.0	N N N
LERMA	T	147	100.0	N N N
LESLIE LYKES	U	92	71.7	Y N Y
LIBERTY SPIRIT	O	4	0.0	N Y N
LIBERTY STAR	O	102	50.9	Y Y Y
LIBERTY SUN	N	53	54.7	Y N Y
LIBERTY VICTORY	S	82	31.7	Y N Y
LIBERTY WAVE	N	12	100.0	N N N
LIRCAY	U	169	60.9	Y N Y
LNG AQUARIUS	F	4	0.0	Y N N
LNG CAPRICORN	Y	34	100.0	N N N
LNG LEO	Y	60	73.3	Y Y Y
LNG TAURUS	Y	108	37.9	Y Y Y
LNG VIRGO	Y	77	3.8	Y Y Y
LONDON ENTERPRISE	U	106	100.0	N N N
LONDON SPIRIT	B	42	100.0	N N N
LONG LINES	B	14	100.0	N N N
LONGAVI	T	3	100.0	N N N
LOUISE LYKES	U	12	83.3	Y N Y
LT ARGOSY	C	7	100.0	N N N
LT PRAGATI	S	50	36.0	Y N Y
LT. ODYSSEY	C	20	60.0	Y N N
LUCKY	S	16	100.0	N N N
LUCKY BULKER	N	18	100.0	N N N
LUNA MAERSK	S	110	70.9	Y N N
LURLINE	F	175	38.8	Y Y Y
MAASDAM	T	102	100.0	N N N
MACKINAC BRIDGE	T	185	99.4	Y Y N
MADISON MAERSK	F	76	63.1	Y N N
MAERSK CONSTELLATION	F	103	46.6	Y Y Y
MAERSK LA PLATA	U	78	100.0	N N N
MAERSK SUN	S	44	90.9	Y N Y
MAGIC	K	89	100.0	N N N
MAGLEBY MAERSK	J	148	48.6	Y Y Y
MAJ STEPHEN W PLESS MP	N	50	97.0	N N N
MAJESTIC MAERSK	J	116	19.8	Y Y Y
MANGAL DESAI	C	77	62.3	Y N N
MANUKAI	F	228	32.8	Y Y Y
MARATHA MAJESTY	T	44	100.0	N N N
MARCHEN MAERSK	T	126	50.7	Y Y Y
MAREN MAERSK	T	47	72.3	Y N N
MARGARET LYKES	U	103	44.6	Y Y Y
MARGRETHE MAERSK	T	138	47.1	Y Y Y
MARIA TOPIC	M	3	100.0	N N N
MARIE MAERSK	J	175	38.2	Y Y Y
MARIF	S	35	65.7	Y Y Y
MARINE PRINCESS	O	28	96.4	Y N N
MARINE RELIANCE	K	72	100.0	N N N
MARIT MAERSK	F	84	32.1	Y Y Y
MARJORIE LYKES	O	26	100.0	N N N
MARLIN	O	135	0.0	Y Y N
MATHILDE MAERSK	T	95	0.0	Y N Y
MATSONIA	F	223	65.9	Y Y Y
MAUI	T	142	93.6	Y N Y
MAURICE EWING	J	136	5.8	Y N Y
MAYAGUEZ	K	111	69.3	Y Y N
MAYVIEW MAERSK	F	82	50.0	Y Y Y
MC-KINNEY MAERSK	J	89	68.5	Y N Y
MEDALLION	K	27	100.0	N N N
MEDUSA CHALLENGER	C	372	82.2	Y Y Y
MELBOURNE STAR	J	129	100.0	N N N
MELVILLE	T	269	80.2	Y Y Y
MERCANDIAN ARROW	M	119	0.8	Y Y Y
MERCHANT PATRIOT	U	5	100.0	N N N
MERCHANT PREMIER	S	47	100.0	N N N
MERCHANT PRINCE	U	74	100.0	N N N
MERCHANT PRINCIPAL	S	173	100.0	N N N
MERCURY DIAMOND	T	75	100.0	N N N
MERIDA	U	92	100.0	N N N
MESABI MINER	C	200	74.5	Y Y Y
METTE MAERSK	T	105	53.3	Y Y Y
MICHIGAN	G	352	32.1	Y Y Y
MICHIGAN HIGHWAY	B	66	100.0	N N N
MICRONESIAN PRIDE	T	72	100.0	N N N
MIDDLETOWN	C	226	65.4	Y Y Y
MINERAL OSPREY	M	70	100.0	N N N
MING PLEASURE	T	82	100.0	N N N

October, November and December 1994

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no (month) O N D
MING PROPITIOUS	J	11	100.0	N N N
MITLA	U	172	20.3	Y Y Y
MOANA PACIFIC	T	91	100.0	N N N
MOKU PAHU	F	131	72.5	Y Y Y
MONTERREY	T	88	100.0	N N N
MORELOS	T	176	87.5	Y N Y
MORMACSKY	Y	1	100.0	N N N
MORMACSTAR	U	136	40.4	Y Y N
MORMACSUN	N	117	34.1	Y Y Y
MT. CABRITE	T	16	100.0	N N N
MYRON C. TAYLOR	G	199	79.8	Y N Y
MYSTIC	T	17	100.0	N N N
NACIONAL SANTOS	O	4	100.0	N N N
NACIONAL VITORIA	U	117	66.6	Y Y Y
NATIONAL DIGNITY	T	36	94.4	Y Y N
NATIONAL HONOR	T	55	52.7	Y Y Y
NATIONAL PRIDE	T	131	23.6	Y Y Y
NEDLLOYD HOLLAND	U	106	64.1	Y N Y
NEDLLOYD ROTTERDAM	J	25	100.0	N N N
NEDLLOYD VAN CLOON	T	108	100.0	N N N
NEDLLOYD VAN DAJIMA	U	60	100.0	N N N
NEDLLOYD VAN DIEMEN	T	2	100.0	N N N
NEDLLOYD VAN LINSCHOTE	F	31	100.0	N N N
NEDLLOYD VAN NECK	F	185	100.0	N N N
NEDLLOYD VAN NOORT	F	26	100.0	N N N
NEDLLOYD VITORIA	F	38	100.0	N N N
NEDLLOYS MAURITIUS	T	26	100.0	N N N
NEPTUNE AMBER	S	53	100.0	N N N
NEPTUNE CORAL	T	11	100.0	N N N
NEPTUNE CRYSTAL	S	48	100.0	N N N
NEPTUNE DIAMOND	T	79	100.0	N N N
NEPTUNE GARNET	S	41	100.0	N N N
NEPTUNE JADE	N	41	100.0	N N N
NEPTUNE PEARL	T	30	100.0	N N N
NEPTUNE RHODONITE	T	55	30.9	Y Y Y
NEW CARISSA	S	233	23.1	Y N Y
NEW HORIZON	T	139	51.7	Y N N
NEWARK BAY	U	102	100.0	N N N
NEWPORT BRIDGE	F	81	100.0	N N N
NIEUW AMSTERDAM	T	27	100.0	N N N
NOAA DAVID STARR JORDA	S	44	100.0	N N N
NOAA SHIP ALBATROSS IV	N	152	30.2	Y N N
NOAA SHIP CHAPMAN	O	24	50.0	Y N N
NOAA SHIP DELAWARE II	Y	363	84.2	Y N Y
NOAA SHIP DISCOVERER O	S	521	78.3	Y Y Y
NOAA SHIP FERREL	N	221	63.8	Y N N
NOAA SHIP M. BALDRIDGE	M	36	80.5	Y N N
NOAA SHIP MILLER FREEM	S	335	79.1	Y Y N
NOAA SHIP MT MITCHEL	N	377	58.1	Y Y N
NOAA SHIP OREGON II	O	417	96.4	Y Y Y
NOAA SHIP RAINIER	S	207	56.5	Y Y N
NOAA SHIP SURVEYOR	S	108	64.8	Y N Y
NOAA SHIP T. CROMWELL	S	32	100.0	N N N
NOAA SHIP WHITING	B	110	65.4	Y Y N
NOBEL STAR	U	87	100.0	N N N
NOMADIC MERMAID	S	21	100.0	N N N
NORD JAHRE TARGET	B	155	78.7	Y Y N
NORTHERN LIGHTS	O	179	82.6	Y Y N
NORTHERN LION	T	270	97.0	Y N Y
NORWAY	M	243	41.1	Y Y N
NOSAC CEDAR	S	22	100.0	N N N
NOSAC EXPLORER	S	7	100.0	N N N
NOSAC EXPRESS	T	37	48.6	Y Y N
NOSAC RANGER	N	209	42.5	Y Y Y
NOSAC TAI SHAN	K	86	47.6	Y N N
NOSAC TAKAYAMA	J	179	59.2	Y N N
NUEVO LEON	U	72	86.1	Y N Y
NUEVO SAN JUAN	N	47	40.4	Y N N
NURNBERG ATLANTIC	N	1000	100.0	N N N
NYK SEABREEZE	S	103	100.0	N N N
NYK SPRINGTIDE	U	141	100.0	N N N
NYK STARLIGHT	T	87	100.0	N N N
NYK SUNRISE	S	73	100.0	N N N
NYK SURFWIND	S	22	100.0	N N N
OAXACA	T	96	100.0	N N N
OBO ENGIN	T	65	100.0	N N N
OCEAN EXPLORER	U	26	100.0	N N N
OCEAN HIGHWAY	T	34	100.0	N N N
OCEAN LEADER	U	11	100.0	N N N
OCEAN SPIRIT	N	106	100.0	N N N
OCEANUS OSAKA	J	73	45.2	Y N Y
ODELIA	S	19	84.2	Y Y Y
OGLEBAY NORTON	C	13	0.0	N Y N
OLIVE ACE	T	19	100.0	N N N
OLIVEBANK	B	69	100.0	N N N
OMI MISSOURI	K	197	47.7	Y N Y
OOCL BRAVERY	N	92	100.0	N N N
OOCL EDUCATOR	F	104	81.7	Y Y Y
OOCL ENVOY	S	64	100.0	N N N
OOCL EXECUTIVE	S	92	95.6	Y N Y
OOCL EXPLORER	S	80	68.7	Y Y Y
OOCL EXPORTER	S	126	96.8	Y Y N
OOCL FAIR	T	116	88.7	Y Y Y
OOCL FAITH	N	84	100.0	N N N
OOCL FAME	U	76	100.0	N N N
OOCL FIDELITY	T	119	84.8	Y N Y
OOCL FORTUNE	T	156	83.3	Y N Y
OOCL FREEDOM	N	176	100.0	N N N
OOCL FRIENDSHIP	T	53	100.0	N N N
OOCL INNOVATION	N	66	100.0	N N N
OOCL INSPIRATION	U	134	52.9	Y Y Y
ORANGE STAR	J	35	0.0	N N Y
ORION HIGHWAY	K	178	78.6	Y Y N
OURO DO BRASIL	B	44	0.0	Y N N
OVERSEAS ALASKA	S	44	45.4	Y Y Y
OVERSEAS ARCTIC	O	36	88.8	Y Y N
OVERSEAS HARRIET	U	49	100.0	N N N
OVERSEAS JOYCE	K	125	43.2	Y Y Y
OVERSEAS MARILYN	U	24	100.0	N N N
OVERSEAS NEW ORLEANS	U	42	100.0	N N N
OVERSEAS OHIO	F	113	61.9	Y Y Y
PACDUKE	S	26	100.0	N N N
PACIFIC EMERALD	S	75	94.6	Y Y Y
PACKING	S	5	100.0	N N N
PACMERCHANT	S	43	100.0	N N N
PACPRINCE	S	28	100.0	N N N
PACPRINCESS	U	21	100.0	N N N
PACSUN	S	47	100.0	N N N
PADRONE	J	62	53.2	Y Y Y
PALMGRACHT	B	19	100.0	N N N
PAPAGO	S	140	75.7	Y Y Y
PARIS SENATOR	N	15	100.0	N N N
PATRIOT	U	36	100.0	N N N
PAUL BUCK	U	20	100.0	N N N
PAUL H. TOWNSEND	C	184	83.6	Y Y Y
PAUL R. TREGURTHA	C	280	87.1	Y Y Y
PAUL THAYER	C	48	81.2	Y Y N
PEMBINA	F	27	100.0	N N N
PETER W. ANDERSON	N	2	100.0	N N N
PETROBULK RACER	M	90	0.0	Y Y Y
PFC DEWAYNE T. WILLIAM	N	18	100.0	N N N
PFC EUGENE A. OBREGON	N	22	26.2	Y Y N
PFC JAMES ANDERSON JR	J	69	47.3	Y Y Y
PHAROS	N	100	100.0	N N N
PHILIP R. CLARKE	G	109	65.1	Y Y Y
PHOENIX DIAMOND	N	52	100.0	N N N
PISCES PIONEER	S	114	100.0	N N N
PISCES PLANTER	U	176	100.0	N N N
PLATTE	O	133	46.6	Y Y Y
POLYNESIA	T	181	66.2	Y N N
POOLGRACHT	B	103	100.0	N N N
POROS	O	53	1.8	Y Y Y
POTOMAC TRADER	U	33	100.0	N N N
PRESIDENT ADAMS	F	197	49.2	Y N Y
PRESIDENT ARTHUR	F	121	38.8	Y N Y
PRESIDENT BUCHANAN	F	23	39.1	Y Y N
PRESIDENT EISENHOWER	T	108	0.0	Y N Y
PRESIDENT F. ROOSEVELT	T	197	97.6	Y Y Y
PRESIDENT GARFIELD	F	61	54.0	Y N Y
PRESIDENT GRANT	S	117	47.8	Y Y Y
PRESIDENT HARDING	F	121	63.6	Y N Y
PRESIDENT HARRISON	S	96	100.0	N N N
PRESIDENT HOOVER	S	146	8.9	Y Y Y
PRESIDENT JACKSON	S	155	7.0	Y Y N
PRESIDENT JEFFERSON	S	148	37.1	Y Y Y
PRESIDENT KENNEDY	F	134	79.8	Y Y Y
PRESIDENT LINCOLN	F	254	57.4	Y Y Y
PRESIDENT MONROE	F	206	63.5	Y Y N
PRESIDENT POLK	F	183	74.8	Y Y Y
PRESIDENT TRUMAN	F	155	57.4	Y Y Y
PRESIDENT TYLER	S	229	36.6	Y Y Y
PRESIDENT WASHINGTON	F	347	46.1	Y Y Y
PRESQUE ISLE	C	66	87.8	Y Y N
PRIDE OF BALTIMORE	B	60	95.0	Y Y N
PRINCE OF OCEAN	S	66	100.0	N N N
PRINCE OF TOKYO	S	219	21.4	Y Y Y
PRINCE OF TOKYO 2	S	132	81.0	Y Y N
PRINCE WILLIAM SOUND	T	182	47.8	Y Y Y
PROJECT ORIENT	B	64	100.0	N N N
PROSPERO	K	55	100.0	N N N
PUERTO CORTES	K	154	100.0	N N N
PVT FRANKLIN J. PHILLI	N	64	54.6	Y N Y
PYTCHLEY	N	148	100.0	N N N
QUALITY OF LIFE	K	5	100.0	N N N
QUEEN ELIZABETH 2	Y	106	100.0	N N N
QUEENSLAND STAR	U	183	100.0	N N N
R.J. PFEIFFER	T	200	67.0	Y Y Y
RAINBOW WARRIOR	F	64	100.0	N N N
RANI PADMINI	N	19	100.0	N N N
RECIFE	U	10	100.0	N N N
REGAL EMPRESS	Y	31	100.0	N N N
REGAL PRINCESS	M	96	84.3	Y Y Y
REGINA J	M	5	100.0	N N N

October, November and December 1994

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no (month) O N D
REPULSE BAY	U	181	100.0	N N N
RESERVE	C	147	60.5	Y Y Y
RESOLUTE	N	180	12.7	Y Y Y
RHINE FOREST	O	131	60.3	Y N Y
RICHARD G MATTIESEN	K	98	48.9	Y Y N
RICHARD REISS	C	77	67.5	Y Y N
RICHMOND BAY	U	2	100.0	N N N
ROBERT E. LEE	O	14	100.0	N N N
ROGER BLOUGH	G	66	100.0	N N N
ROSINA TOPIC	S	111	27.9	Y N Y
ROTTERDAM	Y	65	100.0	N N N
ROVER	U	53	100.0	N N N
ROWANBANK	N	71	100.0	N N N
ROYAL PRINCESS	T	69	100.0	N N N
RUBIN DOGA	S	3	100.0	N N N
RUBIN OCEAN	S	12	100.0	N N N
RYNDAM	M	69	100.0	N N N
S.T. CRAPO	C	77	84.4	Y N N
SALINA CRUZ PILOTS	T	6	100.0	N N N
SALINAS	S	21	100.0	N N N
SALOME	J	295	59.3	Y Y N
SAM HOUSTON	U	72	52.7	Y Y Y
SAMUAL GINN	F	168	27.3	Y N Y
SAMUEL H. ARMACOST	F	113	57.5	Y Y Y
SAMUEL L. COBB	F	51	98.0	Y Y N
SAMUEL RISLEY	N	49	100.0	N N N
SAN ISIDRO	N	159	100.0	N N N
SAN LORENZO	B	6	100.0	N N N
SAN MARCOS	K	178	100.0	N N N
SAN PEDRO	N	15	100.0	N N N
SAN VINCENTE	N	14	100.0	N N N
SANTA MONICA	N	115	100.0	N N N
SANTA PAULA	O	299	67.5	Y Y Y
SANTORIN 2	S	289	23.5	Y Y Y
SAPAI	U	56	100.0	N N N
SARAJEVO EXPRESS	B	44	100.0	N N N
SATURN DIAMOND	K	31	100.0	N N N
SAVANNAH	N	26	100.0	N N N
SCARAB	K	9	100.0	N N N
SEA FORTUNE	S	103	40.7	Y Y N
SEA FOX	K	168	83.9	Y Y Y
SEA ISLE CITY	U	25	100.0	N N N
SEA LION	K	377	91.2	Y Y N
SEA PRINCESS	O	84	100.0	N N N
SEA SPRAY	J	7	100.0	N N N
SEA TRADE	N	123	78.0	Y N N
SEA WOLF	K	272	72.4	Y Y N
SEA-LAND SHINING STAR	U	598	51.2	Y Y Y
SEABOARD OCEAN	M	258	72.8	Y Y Y
SEABOARD SUN	K	43	100.0	N N N
SEABOARD UNIVERSE	M	230	56.0	Y Y N
SEACON	M	1	100.0	N N N
SEALAND ANCHORAGE	S	186	34.9	Y Y Y
SEALAND ATLANTIC	U	217	61.2	Y Y Y
SEALAND CHALLENGER	J	151	40.3	Y Y N
SEALAND CONSUMER	T	291	70.4	Y Y Y
SEALAND COSTA RICA	O	190	75.7	Y Y Y
SEALAND CRUSADER	K	171	64.9	Y Y N
SEALAND DEFENDER	F	61	63.9	Y Y N
SEALAND DEVELOPER	S	245	36.3	Y Y Y
SEALAND DISCOVERY	K	54	62.9	Y N N
SEALAND ENDURANCE	S	135	42.2	Y Y N
SEALAND ENTERPRISE	F	226	83.1	Y Y Y
SEALAND EXPEDITION	K	1	100.0	N N N
SEALAND EXPLORER	T	175	50.8	Y N Y
SEALAND EXPRESS	S	267	71.5	Y Y Y
SEALAND HAWAII	F	220	86.8	Y Y Y
SEALAND HONDURAS	O	9	100.0	N N N
SEALAND INDEPENDENCE	S	180	47.2	Y Y Y
SEALAND INNOVATOR	F	102	94.1	Y Y Y
SEALAND INTEGRITY	U	318	100.0	N N N
SEALAND KODIAK	S	59	16.9	Y N N
SEALAND LIBERATOR	F	206	31.5	Y Y Y
SEALAND MARINER	S	116	84.4	Y N N
SEALAND NAVIGATOR	T	215	100.0	N N N
SEALAND PACIFIC	T	265	82.6	Y Y Y
SEALAND PATRIOT	F	54	100.0	N N N
SEALAND PERFORMANCE	N	179	31.2	Y Y Y
SEALAND PRODUCER	T	214	41.1	Y Y Y
SEALAND QUALITY	K	53	86.7	Y N N
SEALAND RELIANCE	T	339	21.5	Y Y Y
SEALAND SPIRIT	F	255	30.9	Y Y N
SEALAND TACOMA	S	117	54.7	Y N N
SEALAND TRADER	F	190	94.7	Y Y Y
SEALAND VOYAGER	S	143	59.4	Y Y Y
SEARIVER BATON ROUGE	F	37	67.5	Y N Y
SEARIVER BENICIA	T	40	50.0	Y Y N
SEARIVER CHARLESTOWN	U	4	100.0	N N N
SEARIVER LONG BEACH	T	4	100.0	N N N
SEARIVER MEDITERRANEAN	T	11	100.0	N N N
SEARIVER MEDITERRANE	T	11	90.9	Y Y N

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no (month) O N D
SEARIVER NORTH SLOPE	F	33	100.0	N N N
SEARIVER PHILADELPHIA	F	23	17.4	N Y N
SEARIVER SAN FRANCISCO	F	23	95.6	N Y N
SEAWARD JOHNSON	M	110	11.8	Y Y Y
SEDCO/BP 471	N	219	91.7	Y Y Y
SENATOR	M	134	85.8	Y Y N
SENORITA	M	72	0.0	N Y Y
SENSATION	M	54	59.2	Y Y Y
SERAFIN TOPIC	B	45	100.0	N N N
SEVEN OCEAN	S	38	71.0	Y N N
SGT WILLIAM A BUTTON	N	4	100.0	N N N
SGT. METEJ KOCAK	N	74	2.7	Y Y N
SHELDON LYKES	U	160	41.2	Y Y Y
SHELLY BAY	M	139	72.6	Y N Y
SHIRAOI MARU	S	154	89.6	Y Y Y
SIDNEY STAR	U	113	100.0	N N N
SKANDERBORG	U	5	100.0	N N N
SKAUBRYN	S	103	100.0	N N N
SKAUGRAN	S	165	100.0	N N N
SKOGAFOSS	N	98	100.0	N N N
SKY PRINCESS	M	57	100.0	N N N
SN	U	286	100.0	N N N
SOKOLICA	B	22	100.0	N N N
SOL DO BRASIL	B	12	100.0	N N N
SOLAR WING	K	29	79.3	Y N N
SOREN TOUBRO	C	9	100.0	N N N
SOUTHERN PRINCESS	J	78	0.0	Y N N
SOVEREIGN_OF THE SEAS	M	1	100.0	N N N
SPRING TIGER	B	4	100.0	N N N
ST BLAIZE	N	74	100.0	N N N
ST. LUCIA	N	33	100.0	N N N
STAFFORDSHIRE	U	49	100.0	N N N
STAR ALABAMA	T	23	100.0	N N N
STAR AMERICA	K	153	30.7	Y Y Y
STAR DAVANGER	S	23	100.0	N N N
STAR DOVER	S	50	100.0	N N N
STAR DRIVANGER	T	97	100.0	N N N
STAR EAGLE	U	102	100.0	N N N
STAR EVVIVA	K	45	100.0	N N N
STAR FLORIDA	U	111	100.0	N N N
STAR FRASER	U	21	100.0	N N N
STAR FUJI	S	54	100.0	N N N
STAR GEIRANGER	T	8	100.0	N N N
STAR GEORGIA	U	9	100.0	N N N
STAR GRAN	T	103	36.8	Y Y Y
STAR SKARVEN	M	45	53.3	Y Y Y
STAR SKOGANGER	U	36	66.6	Y Y Y
STAR STRONEN	U	31	100.0	N N N
STARSHIP MAJESTIC	B	11	36.3	Y N N
STATE OF GUIARAT	U	17	100.0	N N N
STELLA LYKES	U	114	57.8	Y Y N
STELLAR BENY	S	43	100.0	N N N
STELLAR VENUS	S	25	100.0	N N N
STEWART J. CORT	G	519	49.1	Y Y Y
STOLT CONDOR	J	18	100.0	N N N
STONEWALL JACKSON	O	35	51.4	Y Y N
STRONG VIRGINIAN	F	61	42.6	Y Y Y
STUTTGART EXPRESS	J	4	100.0	N N N
SUE LYKES	U	117	65.8	Y Y N
SUGAR ISLANDER	U	56	55.3	Y N N
SUN VIKING	M	6	100.0	N N N
SUNBELT DIXIE	B	36	100.0	N N N
SUNMAR STAR	S	31	100.0	N N N
SUNRISE RUBY	S	4	100.0	N N N
SYNNOVE KNUSTEN	K	4	0.0	N N Y
TADEUSZ OCIOSZYNSKI	U	5	100.0	N N N
TAI CHUNG	S	152	100.0	N N N
TAI HE	T	182	100.0	N N N
TAI SHING	S	78	42.3	Y Y Y
TAMAMONTA	U	37	100.0	N N N
TAMATHAI	U	74	100.0	N N N
TAMPA	T	16	100.0	N N N
TAMPA BAY	U	86	83.7	Y N N
TEAL ARROW	J	76	94.7	Y Y N
TEXAS SUN	U	20	100.0	N N N
THOMAS G. THOMPSON	S	134	0.0	Y N Y
THOMPSON LYKES	U	28	100.0	N N N
THOMPSON PASS	S	29	31.0	Y Y Y
TILLIE LYKES	U	48	100.0	N N N
TOHZAN	K	26	100.0	N N N
TOKYO HIGHWAY	T	11	100.0	N N N
TOKYO SENATOR	T	90	100.0	N N N
TOLUCA	T	118	100.0	N N N
TONSINA	U	31	100.0	N N N
TORM FREYA	N	136	59.5	Y Y Y
TOWER BRIDGE	S	56	100.0	N N N
TRANSWORLD BRIDGE	S	170	83.5	Y Y N
TRINIDAD & TABAGO	B	20	100.0	N N N
TRITON	G	138	73.9	Y Y Y
TROPIC DAY	M	104	5.7	Y Y Y
TROPIC FLYER	M	110	5.4	Y N N

October, November and December 1994

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
TROPIC JADE	M	82	9.7	Y N Y
TROPIC KEY	M	1	100.0	N N N
TROPIC LURE	M	73	16.4	Y N Y
TROPIC MIST	M	71	0.0	Y N Y
TROPIC OPAL	M	87	0.0	Y Y N
TROPIC PALM	M	51	0.0	Y Y Y
TROPIC SUN	M	372	70.9	Y Y Y
TROPIC TIDE	M	125	31.2	Y Y Y
TSL BOLD	B	3	0.0	Y N N
TULSIDAS	N	26	100.0	N N N
TUSTUMENA	S	11	100.0	N N N
TYSON LYKES	U	98	29.5	Y N Y
UCHOA	J	64	34.3	Y Y N
ULLSWATER	N	228	100.0	N N N
ULTRAMAX	U	27	14.8	Y N N
ULTRASEA	O	26	34.6	Y Y N
USCGC ACACIA (WLB406)	G	8	100.0	N N N
USCGC ACACIA (WLB406	G	9	100.0	N N N
USCGC ACTIVE WMEC 61	S	3	100.0	N N N
USCGC ACUSHNET WMEC	F	8	100.0	N N N
USCGC ACUSHNET WMEC 16	F	14	100.0	N N N
USCGC BEAR (WEMC 901)	N	102	35.3	Y Y Y
USCGC BISCAYNE BAY	G	18	33.3	Y Y Y
USCGC BOUTWELL WHEC 71	S	29	100.0	N N N
USCGC BRAMBLE (WLB 3	C	17	100.0	N N N
USCGC CAMPBELL	N	37	89.1	Y N Y
USCGC CHASE (WHEC 718)	T	35	100.0	N N N
USCGC CHASE (WHEC 71	T	7	100.0	N N N
USCGC CONFIDENCE WME	K	13	100.0	N N N
USCGC COURAGEOUS	N	34	64.7	Y Y N
USCGC DECISIVE WMEC 62	M	15	100.0	N N N
USCGC DEPENDABLE	U	22	100.0	N N N
USCGC DILIGENCE WMEC 6	N	15	100.0	N N N
USCGC DURABLE (WMEC	U	32	100.0	N N N
USCGC ESCANABA	N	24	100.0	N N N
USCGC FIREBUSH WLB 393	A	34	100.0	N N N
USCGC FORWARD	N	1	100.0	N N N
USCGC HAMILTON WHEC 71	T	35	100.0	N N N
USCGC HARRIET LANE	N	39	100.0	N N N
USCGC JARVIS (WHEC 7	S	12	100.0	N N N
USCGC KATMAI BAY	G	12	66.6	N Y N
USCGC LAUREL (WLB 291)	F	13	100.0	N N N
USCGC LEGARE	N	37	100.0	N N N
USCGC MACKINAW	G	23	47.8	Y N Y
USCGC MALLOW (WLB 396)	S	17	100.0	N N N
USCGC MIDGETT (WHEC 72	S	172	47.1	Y Y N
USCGC MOHAWK WMEC 913	K	112	35.7	Y N N
USCGC MORGENTHAU	F	28	100.0	N N N
USCGC MUNRO	Y	135	97.0	Y Y Y
USCGC NORTHLAND WMEC 9	N	151	62.2	Y N N
USCGC POLAR SEA__(WAGB	S	182	88.4	Y N N
USCGC POLAR STAR (WAGB	S	248	100.0	N N N
USCGC RUSH	F	88	100.0	N N N
USCGC SEDGE (WLB 402)	S	4	100.0	N N N
USCGC SENECA	N	24	100.0	N N N
USCGC SHERMAN	F	12	0.0	Y N N
USCGC SPENCER	N	36	100.0	N N N
USCGC STEADFAST (WMEC	S	61	100.0	N N N
USCGC STEADFAST (WMEC	S	17	70.6	Y N Y
USCGC STORIS (WMEC 38)	S	165	63 0	N Y N
USCGC SUNDEW (WLB 404)	G	14	100.0	N N N
USCGC TAHOMA	N	20	100.0	N N N
USCGC VALIANT (WMEC 62	M	49	55.1	Y N Y
USCGC VIGILANT WMEC 61	M	6	100.0	N N N
USCGC VIGOROUS WMEC 62	B	62	75.4	Y N Y
USCGC YOCONA (WMEC 168	S	21	71.4	Y Y Y
USNS APACHE (T-ATF 172	N	129	74.6	Y Y Y
USNS CATAWBA T-ATF 168	S	53	100.0	N N N
USNS CONCORD	M	136	0.0	Y N Y
USNS DENEBOLA	J	1	100.0	N N N
USNS EFFECTIVE TAGOS-2	N	113	0.0	Y N N
USNS GUADALUPE	O	76	100.0	N N N
USNS GUS W. DARNELL	U	31	100.0	N N N
USNS JOHN MCDONNELL	O	239	52.2	Y Y Y
USNS JOSHUA HUMPHREYS	N	50	100.0	N N N
USNS LEROY GRUMMAN	N	7	0.0	Y N N
USNS LITTLEHALES (T-AG	O	3	100.0	N N N
USNS MARS	F	2	100.0	N N N
USNS MOHAWK (T-ATF 170	N	6	0.0	Y N N
USNS NARRAGANSETT	T	23	73.9	Y N Y
USNS NAVAJO_(TATF-169)	T	96	100.0	N N N
USNS POWHATAN TATF 166	N	35	100.0	N N N
USNS SAN DIEGO	N	2	50.0	Y N N
USNS SATURN T-AFS-10	N	28	0.0	Y N N
USNS SEALIFT ANTARCTIC	U	40	100.0	N N N
USNS SEALIFT ARCTIC	U	144	59.0	Y Y Y
USNS SEALIFT ATLANTIC	U	179	97.2	Y Y Y
USNS SEALIFT CARIBBEAN	U	103	100.0	N N N
USNS SEALIFT CHINA SEA	U	165	86.8	Y Y Y
USNS SEALIFT INDIAN OC	U	16	100.0	N N N
USNS SEALIFT MEDITERRA	U	81	100.0	N N N
USNS SILAS BENT T-AGS	F	49	100.0	N N N

	PMO	No. Obs.	% via Radio	Forms Y-yes; N-no O N D (month)
USNS VANGUARD TAG 194	J	172	87.6	Y Y N
USNS WALTER S. DIEHL	F	147	0.0	Y Y Y
USNS WILKES T-AGS-33	N	106	94.3	Y N N
USNS WYMAN (T-AGS 34)	J	8	100.0	N N N
VENUS DIAMOND	U	73	100.0	N N N
VERA ACORDE	S	16	0.0	N N Y
VINA DEL MAR	U	54	100.0	N N N
VINE	N	268	100.0	N N N
VISAYAS VICTORY	B	76	19.7	Y Y N
VIVA	N	251	30.2	Y Y Y
VOROSMARTY	B	69	0.0	Y Y Y
WALTER J. MCCARTHY	C	53	88.6	Y Y Y
WASHINGTON HIGHWAY	S	59	100.0	N N N
WEST MOOR	N	146	100.0	N N N
WESTERDAM	M	127	100.0	N N N
WESTERN GALLANTRY	B	9	100.0	N N N
WESTERN LION	T	225	99.1	Y N Y
WESTWOOD ANETTE	S	228	65.3	Y Y Y
WESTWOOD BELINDA	S	46	91.3	Y Y Y
WESTWOOD CLEO	S	140	80.0	Y N Y
WESTWOOD JAGO	S	172	48.8	Y Y Y
WESTWOOD MARIANNE	S	115	35.6	Y N Y
WILFRED SYKES	G	101	55.4	Y Y Y
WILLIAM E. CRAIN	F	37	0.0	Y N N
WILLIAM E. MUSSMAN	S	73	31.5	Y N Y
WILLIAM R. ROESCH	C	63	52.3	Y Y Y
WOLVERINE	C	7	71.4	Y Y N
YOUNG SPROUT	S	94	79.7	Y N N
YUCATAN	U	148	100.0	N N N
ZAGREB EXPRESS	N	28	100.0	N N N
ZETLAND	N	177	100.0	N N N
ZIM AMERICA	J	68	100.0	N N N
ZIM CANADA	N	113	100.0	N N N
ZIM HONGKONG	J	1	100.0	N N N
ZIM HOUSTON	J	8	100.0	N N N
ZIM IBERIA	T	33	100.0	N N N
ZIM JAPAN	B	76	100.0	N N N
ZIM KEELUNG	J	75	100.0	N N N
	GRAND TOTAL		94514	
	TOTAL VIA RADIO		67833	
	PERCENT VIA RADIO		71.7	

NDBC Station Data

October, November and December 1994

Wave observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688-1720 for more details.

>BUOY	LAT	LONG	OBS	>MEAN AIR TP >(C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	>MAX SIG >WAVE HT >(DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
OCTOBER 1994													
>32302	18.0S	085.1W	0713	18.4	18.9	2.2	4.0	>05/18	12.1	SE	18.5	07/03	1016.4
>41001	34.7N	072.6W	0716	20.1	22.3	2.4	10.9	>18/04	15.4	SW	47.4	18/02	1019.2
>41002	32.3N	075.2W	0688	21.9	24.3	1.9	5.5	>18/20	14.3	NE	34.6	18/22	1018.4
>41004	32.5N	079.1W	0712	20.6	23.0	1.7	4.7	>11/18	15.1	NE	34.2	11/15	1019.2
>41006	29.3N	077.3W	0713	24.0	25.9	2.0	5.3	>14/20	14.9	E	34.2	17/05	1016.7
>41009	28.5N	080.2W	1432	23.8	25.5	1.7	5.8	>14/22	14.1	E	35.8	14/23	1016.4
>41010	28.9N	078.5W	1432	24.1	25.9	2.2	6.2	>14/22	13.8	E	34.2	17/07	1016.0
>41016	24.6N	076.5W	0712	26.1	27.9	0.7	3.2	>14/01	13.7	E	38.9	13/23	1016.0
>41018	15.0N	075.0W	0714	27.6	28.2	1.5	3.3	>30/03	13.7	E	23.7	29/23	1011.5
>42001	25.9N	089.7W	0712	25.1	26.9	1.1	2.9	>16/04	12.5	NE	26.2	24/02	1016.9
>42002	25.9N	093.6W	0714	25.4	26.4	1.2	3.1	>30/17	11.7	SE	28.2	29/23	1016.4
>42003	25.9N	085.9W	0340	24.8					>7.0	NE	15.0	16/10	1016.5
>42007	30.1N	088.8W	0716	19.1	21.3				>13.1	NE	29.1	28/09	1018.7
>42019	27.9N	095.0W	0717	23.6	25.5	1.7	3.5	>27/19	14.2	SE	27.6	27/11	1016.3
>42020	27.0N	096.5W	0712	24.4	1.5	3.6		>27/14	14.9	SE	28.6	27/13	1016.0
>42035	29.3N	094.4W	0703	20.8	22.4	1.0	2.6	>27/16	12.4	E	24.9	01/07	1017.5
>42036	28.5N	084.5W	0716	23.2	24.1	1.0	3.1	>16/03	12.2	NE	26.4	16/02	1018.0
>42037	24.5N	081.4W	0713	25.4	26.7	0.8	3.0	>16/07	11.6	NE	26.2	14/13	1014.9
>44005	42.9N	069.0W	0714	9.1	10.4	1.9	5.3	>02/18	16.9	W	34.6	24/01	1016.2
>44007	43.5N	070.2W	0583	8.1	10.3	0.9	4.6	>28/16	12.3	W	28.6	23/23	1013.7
>44008	40.5N	069.4W	0713	11.7	13.2	2.3	7.1	>02/17	16.4	W	36.7	22/05	1017.7
>44009	38.5N	074.7W	0683	13.2	14.5	1.5	4.7	>18/04	15.3	NW	30.7	10/11	1019.2
>44011	41.1N	066.6W	0716	10.7	11.2	2.6	7.0	>03/00	15.0	NW	31.3	07/21	1016.8
>44013	42.4N	070.7W	0715	9.3	0.7	3.1		>28/11	14.1	W	34.2	03/01	1016.6
>44014	36.6N	074.8W	0707	17.2	1.9	9.2		>18/12	15.6	N	31.7	17/11	1019.4
>44025	40.3N	073.2W	0708	11.7	13.2	1.6	4.1	>18/00	17.0	W	33.2	07/07	1018.6
>44028	41.4N	071.1W	0340	8.5	11.4	1.4	3.3	>28/20	19.0	NW	39.2	23/23	1019.1
>45002	45.3N	086.4W	0141	8.8	11.1	1.0	2.0	>02/23	15.2	N	26.2	06/19	1010.1
>45003	45.3N	082.8W	0051	6.4	9.6	1.1	2.5	>01/13	16.8	N	29.0	01/12	1008.8
>45005	41.7N	082.4W	0519	10.7	11.7	0.7	2.1	>02/00	13.7	S	32.6	01/22	1018.3
>45007	42.8N	087.1W	0228	10.1	11.3	1.2	3.1	>01/14	14.8	S	29.1	06/08	1013.8
>45008	44.3N	082.4W	0043	7.3	11.3	2.2	3.6	>01/14	18.5	NE	26.7	01/11	1005.7
>45010	43.0N	087.8W	0227	8.6	8.4	0.9	2.2	>06/06	1013.4				
>46001	56.3N	148.2W	0711	6.2	4.6	11.3		>03/14	23.8	W	39.4	26/17	1002.0
>46002	42.5N	130.3W	0713	11.7	14.2	4.2	12.4	>10/05	18.0	NW	42.7	15/03	1018.6
>46003	51.9N	155.9W	0713	4.9	5.8	4.1	9.0	>03/20	22.7	W	37.5	04/07	1016.1
>46005	46.1N	131.0W	0717	9.7	11.6	4.4	11.9	>09/17	19.5	NW	40.8	09/19	1015.4
>46006	40.9N	137.5W	0708	12.9	15.3	3.7	8.9	>09/11	17.8	NW	38.5	09/09	1025.1
>46011	34.9N	120.9W	0715	12.4	13.6	2.6	6.1	>10/21	10.8	NW	31.9	18/09	1018.3
>46012	37.4N	122.7W	0707	12.1	2.5	5.4		>26/12	12.7	NW	31.3	09/16	1019.0
>46013	38.2N	123.3W	0716	10.6	11.5	2.7	6.5	>10/09	12.8	NW	29.7	18/06	1019.7
>46014	39.2N	124.0W	0710	10.2	11.2	2.9	6.8	>10/07	11.8	NW	31.3	09/10	1019.7
>46022	40.8N	124.5W	0711	9.7	10.6	3.4	8.6	>16/07	12.8	N	41.4	09/07	1019.0
>46025	33.8N	119.1W	0588	14.6	15.8	1.1	2.8	>18/15	9.0	NW	28.6	18/13	1017.8
>46026	37.8N	122.8W	0707	11.5	2.1	4.2		>10/10					1019.2
>46027	41.9N	124.4W	0708	9.0	10.1	3.2	7.2	>10/02	11.5	SE	34.4	09/05	1018.4
>46028	35.8N	121.9W	0713	12.2	2.8	6.2		>18/10	12.0	NW	28.0	02/13	1019.4
>46029	46.2N	124.2W	0710	9.6	9.8	3.5	7.4	>16/17	9.0	NW	20.5	01/06	1015.0
>46030	40.4N	124.5W	0716	9.4	10.2	3.1	7.6	>16/06	12.4	N	35.9	09/07	1019.0
>46035	57.0N	177.7W	0684	2.1	4.1	4.3	11.5	>11/17	22.5	W	44.9	14/15	1006.6
>46041	47.4N	124.5W	0221	7.3	9.5	3.6	6.2	>23/07	16.0	SE	31.7	23/06	1014.6
>46042	36.8N	122.4W	0716	11.5	12.5	2.7	5.9	>10/14	12.3	NW	28.4	09/19	1019.3
>46045	33.8N	118.5W	0714	13.9	15.2	0.9	2.8	>18/03	7.6	W	25.8	26/17	1017.4
>46053	34.2N	119.9W	0719	13.9	15.1	1.2	3.1	>17/01	10.5	W	31.7	16/18	1018.7
>46054	34.3N	120.5W	0719	13.3	14.4	2.3	5.2	>16/21	13.5	NW	32.6	16/22	1018.8
>46059	38.0N	130.0W	0710	14.2	16.6	3.5	10.4	>10/14	16.0	N	35.9	10/14	1022.7
>51001	23.4N	162.3W	0701	25.5	26.4				>17.3	E	25.4	17/10	1016.2
>51002	17.2N	157.8W	0718	25.6	26.2	3.1	5.0	>20/11	19.1	E	26.7	20/11	1014.2
>51003	19.1N	160.8W	0238	27.1	2.7	4.3		>19/23	15.4	E	25.7	17/17	1014.1
>51004	17.4N	152.5W	0713	26.3	3.1	5.4		>19/17	19.4	SE	30.1	11/21	1015.9
>51026	21.4N	156.9W	0712	24.3	24.7	2.8	4.8	>17/08	20.7	SE	29.3	18/06	1017.0
>91222	18.1N	145.8E	0611	26.9					>8.4	SE	36.6	03/14	1012.1
>91251	11.4N	162.4E	0344	27.8					>9.8	E	25.3	29/20	1008.2
>91328	8.6N	149.7E	0712	27.9					>6.2	NE	31.1	01/19	1009.9

October, November and December 1994

>BUOY	LAT	LONG	OBS	>MEAN AIR TP >(C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	>MAX SIG >WAVE HT >(DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
>91338	5.3N	153.7E	0406	28.1					>3.4	N	19.4	01/07	1008.5
>91343	7.6N	155.2E	0714	28.0					>4.5	NE	26.9	30/06	1007.9
>91352	6.2N	160.7E	0672	27.9					>6.1	W	18.2	10/15	1009.6
>91355	5.4N	163.0E	0713	27.6					>6.7	E	21.4	01/00	1007.7
>91377	6.1N	172.1E	0273	28.4					>5.1	W	19.0	02/15	1009.9
>ABAN6	44.3N	075.9W	0712	6.1	10.3				>3.5	S	26.6	21/20	
>ALSN6	40.5N	073.8W	0714	10.9	12.8	1.1	3.6	>19/00	18.8	W	42.4	21/22	1019.1
>BURL1	28.9N	089.4W	0714	20.7					>13.6	NE	28.5	28/12	1017.9
>CARO3	43.3N	124.4W	0712	7.6					>11.4	SE	44.9	04/19	1017.1
>CHLV2	36.9N	075.7W	0714	14.3	16.6				>16.7	N	46.8	17/04	1020.1
>CLKN7	34.6N	076.5W	0714	17.1					>12.9	NE	34.3	18/10	1020.3
>CSBF1	29.7N	085.4W	0706	19.6					>6.3	NE	21.7	01/09	1018.9
>DBLN6	42.5N	079.4W	0667	8.9					>16.3	SW	47.3	29/04	1018.4
>DESW1	47.7N	124.5W	0709	7.1					>17.6	SE	51.3	09/01	1013.4
>DISW3	47.1N	090.7W	0710	3.8					>14.4	W	44.7	28/02	1009.9
>DPIA1	30.3N	088.1W	0710	18.5	21.1				>12.1	NE	25.9	30/13	1019.4
>DRYF1	24.6N	082.9W	0713	25.7	26.7				>13.5	NE	31.1	14/22	1015.4
>DSLN7	35.2N	075.3W	0716	19.9	22.1				>19.4	N	59.7	18/10	1019.9
>FBIS1	32.7N	079.9W	0718	17.2					>10.0	NE	28.5	11/03	1019.5
>FFIA2	57.3N	133.6W	0710	2.8					>17.7	SE	40.7	10/22	1001.1
>FPSN7	33.5N	077.6W	0634	19.7	1.5	4.0		>18/05	17.8	NE	46.9	18/19	1019.2
>FWYF1	25.6N	080.1W	0714	25.2	26.4				>15.1	E	44.3	16/17	1015.6
>GDIL1	29.3N	090.0W	0712	20.0	21.4				>11.4	NE	24.2	30/11	1019.0
>GLLN6	43.9N	076.5W	0717	7.6					>18.0	NW	47.5	29/05	1016.6
>IOSN3	43.0N	070.6W	0715	8.1					>14.3	W	40.3	02/22	1016.0
>LKWF1	26.6N	080.0W	0710	24.5	26.0				>12.9	NE	41.2	14/13	1016.7
>LONF1	24.9N	080.9W	0680	25.0	25.7				>12.2	NE	30.2	14/11	1014.8
>MDRM1	44.0N	068.1W	0707	7.7					>19.5	NW	47.3	23/02	1014.6
>MISM1	43.8N	068.9W	0697	7.6					>18.9	W	43.2	28/14	1015.3
>MLRF1	25.0N	080.4W	0703	25.4	26.7				>14.0	E	39.3	14/13	1012.8
>NWPO3	44.6N	124.1W	0710	7.2					>11.1	E	35.5	30/15	1016.1
>PILM4	48.2N	088.4W	0714	3.2					>17.8	NW	46.9	22/00	1013.5
>PTAC1	39.0N	123.7W	0712	9.1					>10.5	N	32.3	25/18	1019.4
>PTAT2	27.8N	097.1W	0712	21.6	22.7				>12.7	SE	27.8	23/13	1016.3
>PTGC1	34.6N	120.7W	0711	12.3					>13.1	N	38.3	26/15	1018.0
>ROAM4	47.9N	089.3W	0712	2.9	5.7				>16.9	W	44.1	18/18	1013.4
>SANF1	24.5N	081.9W	0712	25.4	26.7				>14.3	NE	41.7	14/18	1015.1
>SAUF1	29.9N	081.3W	0714	20.6	21.4				>10.6	N	36.2	17/01	1018.3
>SBIO1	41.6N	082.8W	0715	8.5					>15.8	SW	42.5	01/23	1018.2
>SGNW3	43.8N	087.7W	0714	9.2	10.8				>12.8	N	37.3	27/20	1017.1
>SISW1	48.3N	122.9W	0715	6.8					>16.6	SE	47.3	04/06	1013.1
>SMKF1	24.6N	081.1W	0714	25.4	26.7				>14.6	NE	39.2	14/12	1015.3
>SPGF1	26.7N	079.0W	0709	24.7	26.6				>9.7	E	33.6	14/13	1016.1
>SRST2	29.7N	094.1W	0713	18.8					>9.7	SE	20.4	20/05	1018.1
>STDM4	47.2N	087.2W	0715	4.1					>21.9	S	53.6	19/00	1013.3
>SUPN6	44.5N	075.8W	0711	6.3	10.5				>11.7	SW	34.2	06/23	1017.6
>SVLS1	32.0N	080.7W	0676	19.2	20.0	0.9	2.2	>08/01	15.2	NE	34.7	11/09	1019.3
>THIN6	44.3N	076.0W	0711	6.1									
>TPLM2	38.9N	076.4W	0715	11.9	13.1				>12.9	S	35.7	21/19	1020.0
>TTIW1	48.4N	124.7W	0713	7.0					>16.1	SE	47.8	30/06	1012.9
>WPOW1	47.7N	122.4W	0712	6.9					>11.1	S	35.1	23/07	1014.4
NOVEMBER1994													
>32302	18.0S	085.1W	0738	18.2	18.7	1.8	3.1>	18/07	12.8	SE	21.0	19/03	1016.2
>41001	34.7N	072.6W	0294	21.5	23.9	1.6	3.3>	19/21	12.1	NE	24.3	23/17	1016.8
>41002	32.3N	075.2W	0738	23.4	25.7	2.0	7.1>	16/03	12.9	NE	34.2	03/15	1015.9
>41004	32.5N	079.1W	0734	21.9	24.1	1.6	3.8>	11/23	13.7	NE	41.2	03/07	1016.8
>41006	29.3N	077.3W	0734	25.2	26.9	1.9	5.1>	16/05	12.7	E	29.0	16/08	1014.5
>41009	28.5N	080.2W	1479	25.5	26.6	1.4	4.1>	17/10	11.6	E	28.2	28/01	1014.2
>41010	28.9N	078.5W	1242	25.0	27.0	2.0	5.8>	16/11	11.2	E	26.4	16/02	1014.7
>41016	24.6N	076.5W	0735	27.3	29.0	0.4	1.3>	17/05	10.5	NE	24.4	17/06	1014.5
>41018	15.0N	075.0W	0737	27.8	28.5	1.1	2.5>	04/02	11.6	E	20.6	03/07	1010.8
>42001	25.9N	089.7W	0736	26.3	27.8	1.0	3.2>	01/03	11.2	E	30.1	01/02	1013.1
>42002	25.9N	093.6W	0736	26.2	27.5	1.1	3.4	>01/06	11.8	SE	25.1	01/00	1012.7
>42007	30.1N	088.8W	0738	22.2	24.4	>			13.9	NE	32.6	01/21	1014.4
>42019	27.9N	095.0W	0741	25.2	26.8				>11.8	SE	24.1	17/01	1012.9
>42020	27.0N	096.5W	0737	25.8	28.0	1.2	3.0	>09/08	12.2	SE	26.6	09/12	1012.8
>42035	29.3N	094.4W	0739	23.4	25.2	0.9	2.5	>17/03	11.6	N	25.5	09/07	1013.8
>42036	28.5N	084.5W	0737	25.4	26.4	1.0	4.5	>02/22	11.3	NE	29.7	02/18	1014.8
>42037	24.5N	081.4W	0731	26.8	27.8	0.5	1.9	>31/20	7.8	NE	22.2	17/13	1013.8
>44004	38.5N	070.7W	0457	16.5	21.0	1.8	4.0	>15/22	13.7	N	28.6	02/01	
>44005	42.9N	069.0W	0739	11.4	11.7	1.3	3.6	>19/02	12.4	NW	24.5	11/03	1017.3
>44007	43.5N	070.2W	0735	11.1	12.1	0.6	2.5	>19/06	10.0	NW	20.6	03/19	1016.6
>44008	40.5N	069.4W	0737	15.7	13.9	1.3	3.7	>19/02	10.6	N	23.5	17/16	1017.9
>44009	38.5N	074.7W	0735	15.5	16.8	1.1	4.0	>15/15	11.3	N	27.2	15/11	1019.3
>44011	41.1N	066.6W	0733	12.9	15.1	1.7	5.4	>18/20	11.6	N	28.4	17/06	1016.5
>44013	42.4N	070.7W	0733	12.1	0.7	2.2		>19/08	11.1	NW	22.9	17/08	1017.6
>44014	36.6N	074.8W	0737	17.4	1.5	4.8		>15/15	12.5	N	29.9	15/19	1018.6
>44025	40.3N	073.2W	0734	14.5	15.8	0.9	2.9	>15/13	11.0	NW	25.1	15/10	1018.6
>44028	41.4N	071.1W	0312	12.6	16.0	0.4	1.0	>01/02	11.7	NW	24.9	03/02	1019.3

October, November and December 1994

>BUOY	LAT	LONG	OBS	>MEAN AIR TP >(C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	>MAX SIG >WAVE HT >(DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
>45001	48.1N	087.8W	0405	9.7	9.1	0.9	2.5	>08/06	13.3	SE	25.3	09/14	1014.5
>45002	45.3N	086.4W	0727	11.9	14.2	1.1	4.6	>28/19	15.3	S	32.6	28/19	1015.6
>45003	45.3N	082.8W	0740	10.7	11.8	0.8	2.9	>09/23	13.1	S	27.4	29/01	1016.8
>45004	47.6N	086.5W	0513	9.1	9.0	0.9	3.2	>09/13	13.4	SE	28.0	09/20	1017.4
>45005	41.7N	082.4W	0736	13.6	15.8	0.6	1.6	>15/01	11.9	SW	26.6	24/20	1018.8
>45006	47.3N	089.9W	0618	10.4	10.9	1.0	3.2	>24/01	11.4	SW	26.9	24/00	1014.7
>45007	42.8N	087.1W	0726	12.9	14.6	0.8	2.6	>29/02	13.1	S	28.6	31/22	1017.7
>45008	44.3N	082.4W	0739	12.3	13.8	1.0	2.6	>09/23	12.0	SW	22.5	23/22	1017.4
>45010	43.0N	087.8W	0739	12.3	13.4	0.5	1.9	>01/14	11.5	NE	18.8	01/12	1017.3
>46001	56.3N	148.2W	0730	9.1	3.3	8.3		>16/20	17.4	W	37.7	16/16	998.6
>46002	42.5N	130.3W	0735	16.2	17.2	2.8	5.5	>27/11	14.1	N	30.3	25/10	1018.3
>46003	51.9N	155.9W	0736	6.9	7.7	3.7	7.1	>01/12	19.8	NW	34.4	15/21	1003.7
>46005	46.1N	131.0W	0739	14.3	15.6	3.0	6.1	>27/07	14.9	NW	31.5	25/09	1016.5
>46006	40.9N	137.5W	0730	17.4	18.1	2.7	6.2	>27/12	13.2	S	27.4	25/09	1021.3
>46011	34.9N	120.9W	0739	14.9	15.2	2.1	5.1	>15/10	10.8	NW	29.0	15/01	1013.2
>46012	37.4N	122.7W	0733	14.2	1.9	4.9		>15/04	10.3	NW	34.4	15/02	1014.4
>46013	38.2N	123.3W	0736	12.8	12.9	2.1	4.3	>29/06	11.8	NW	32.4	15/23	1015.1
>46014	39.2N	124.0W	0731	12.6	12.4	2.3	5.0	>29/00	10.8	NW	29.0	15/23	1015.6
>46022	40.8N	124.5W	0735	12.1	11.8	2.4	4.6	>28/12	9.4	N	25.1	16/03	1016.2
>46023	34.3N	120.7W	0738	15.8	15.9	2.1	5.2	>15/07	12.6	NW	28.9	13/05	1013.9
>46025	33.8N	119.1W	0624	17.7	18.6	1.0	2.6	>14/00	6.9	W	24.7	13/10	1012.8
>46026	37.8N	122.8W	0735	13.2	1.7	4.1		>15/03	8.7	NW	28.4	15/03	1014.5
>46027	41.9N	124.4W	0732	11.6	11.1	2.3	4.9	>28/10	9.1	NW	29.3	03/00	1016.1
>46028	35.8N	121.9W	0651	14.9	2.2	4.6		>29/09	12.1	NW	28.8	12/14	1015.0
>46029	46.2N	124.2W	0733	13.1	11.4	2.4	5.8	>31/14	9.3	SW	33.8	31/08	1016.4
>46030	40.4N	124.5W	0736	11.5	10.9	2.2	4.0	>28/13	10.5	N	22.2	15/07	1016.0
>46035	57.0N	177.7W	0722	4.2	6.4	2.7	6.3	>31/04	17.5	N	35.0	21/15	1006.7
>46042	36.8N	122.4W	0738	14.1	14.6	2.1	5.5	>15/08	11.2	NW	27.2	15/06	1014.4
>46045	33.8N	118.5W	0733	17.6	18.3	0.8	2.3	>13/10	6.1	W	18.1	05/13	1012.6
>46053	34.2N	119.9W	0742	16.7	17.1	1.0	2.7	>15/09	8.9	W	31.7	13/01	1013.6
>46054	34.3N	120.5W	0741	15.8	16.1	1.8	4.7	>15/17	14.3	NW	34.0	15/10	1013.5
>46059	38.0N	130.0W	0308	17.3	18.4	2.6	4.5	>27/23	11.7	N	21.8	25/09	1021.8
>51001	23.4N	162.3W	0740	27.8	26.9				>13.7	NE	26.8	01/17	1014.0
>51002	17.2N	157.8W	0740	26.7	27.3	2.4	3.7	>19/20	16.1	E	25.3	21/02	1012.7
>51003	19.1N	160.8W	0667	27.7	2.0	3.4		>21/00	12.5	E	22.8	21/01	1012.2
>51004	17.4N	152.5W	0736	27.4	2.3	3.7		>20/20	15.8	NE	24.5	19/03	1014.0
>51026	21.4N	156.9W	0737	25.4	26.0	1.9	3.6	>19/09	15.8	E	26.0	19/12	1014.6
>91222	18.1N	145.8E	0676	27.8					>7.3	E	21.4	19/22	1008.5
>91251	11.4N	162.4E	0444	28.0					>8.8	NE	25.3	15/17	1008.5
>91328	8.6N	149.7E	0733	27.7					>9.3	W	23.9	22/02	1010.5
>91338	5.3N	153.7E	0422	27.7					>5.9	NE	17.5	12/03	1009.5
>91343	7.6N	155.2E	0736	27.8					>3.5	W	19.4	31/22	1008.8
>91352	6.2N	160.7E	0263	27.9					>7.7	SW	33.0	02/08	1011.4
>91355	5.4N	163.0E	0738	27.4					>8.1	SW	33.3	13/16	1009.0
>91377	6.1N	172.1E	0367	28.2					>5.5	SW	14.1	28/11	1011.3
>ABAN6	44.3N	075.9W	0735	10.4	14.3				>3.1	S	18.3	14/21	
>ALSN6	40.5N	073.8W	0737	13.9	16.0	0.6	1.9	>15/11	11.9	NW	28.4	15/10	1019.3
>BURL1	28.9N	089.4W	0732	23.5					>13.1	E	29.6	01/13	1013.6
>CARO3	43.3N	124.4W	0735	11.4					>8.7	N	35.1	27/13	1016.6
>CHLV2	36.9N	075.7W	0738	16.7	18.7				>14.8	NE	37.1	15/17	1019.3
>CLKN7	34.6N	076.5W	0736	19.2					>11.7	NE	31.1	03/19	1018.6
>CSBF1	29.7N	085.4W	0731	22.1					>6.9	NE	35.5	02/18	1015.2
>DBLN6	42.5N	079.4W	0738	12.0					>9.3	SW	30.3	24/17	1020.0
>DESW1	47.7N	124.5W	0741	10.8					>10.7	SE	47.0	31/10	1015.5
>DISW3	47.1N	090.7W	0736	10.1					>13.3	SW	40.9	24/01	1014.5
>DPIA1	30.3N	088.1W	0308	21.0					>9.8	NE	23.6	26/11	1017.0
>DRYF1	24.6N	082.9W	0733	27.1	28.3				>9.0	E	27.7	31/21	1013.9
>DSLN7	35.2N	075.3W	0736	20.3	24.0	1.5	3.3	>11/13	17.4	N	47.8	14/22	1018.5
>FBIS1	32.7N	079.9W	0739	19.4					>10.2	NE	31.3	03/06	1017.2
>FFIA2	57.3N	133.6W	0733	7.9					>13.6	SE	32.5	16/09	1007.2
>FPSN7	33.5N	077.6W	0716	21.0	1.5	4.2		>14/01	16.0	NE	45.2	15/21	1016.9
>FWYF1	25.6N	080.1W	0736	26.6	27.8				>10.5	E	31.3	31/12	1014.3
>GDIL1	29.3N	090.0W	0730	22.6	24.6				>11.1	E	26.9	10/03	1014.7
>GLLN6	43.9N	076.5W	0736	11.8					>11.6	W	32.0	09/22	1018.0
>IOSN3	43.0N	070.6W	0734	11.4					>11.4	NW	26.0	17/10	1017.3
>LKWF1	26.6N	080.0W	0725	26.0	27.5				>9.6	E	29.7	16/14	1014.9
>LONF1	24.9N	080.9W	0733	26.7	27.9				>8.6	E	26.4	31/12	1013.9
>MDRM1	44.0N	068.1W	0735	10.6					>15.2	NW	35.6	22/00	1016.2
>MISM1	43.8N	068.9W	0733	10.6					>14.7	SW	33.8	21/21	1016.6
>MLRF1	25.0N	080.4W	0735	26.9	28.0				>9.5	E	27.9	31/12	1013.6
>NWPO3	44.6N	124.1W	0735	10.9					>8.1	E	41.9	31/15	1016.4
>PILM4	48.2N	088.4W	0737	8.9					>16.4	W	41.3	24/05	1013.7
>PTAC1	39.0N	123.7W	0729	12.0					>9.4	N	26.4	13/12	1015.3
>PTAT2	27.8N	097.1W	0734	24.1	25.5				>11.7	SE	24.6	15/05	1013.0
>PTGC1	34.6N	120.7W	0732	15.1					>13.9	N	40.6	15/06	1012.9
>ROAM4	47.9N	089.3W	0735	9.1	9.8				>16.2	SW	38.9	24/03	1013.7
>SANF1	24.5N	081.9W	0736	26.8	28.1				>9.5	E	28.4	17/15	1013.9
>SAUF1	29.9N	081.3W	0692	23.3	24.5				>11.6	NE	28.4	16/09	1015.3
>SBIO1	41.6N	082.8W	0737	13.3					>10.9	NE	29.5	10/00	1019.0

October, November and December 1994

>BUOY	LAT	LONG	OBS	>MEAN AIR TP >(C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	>MAX SIG >WAVE HT >(DA HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
>SGNW3	43.8N	087.7W	0735	14.1	13.6				>11.1	S	26.0	28/22	1018.2
>SISW1	48.3N	122.9W	0739	10.3					>8.7	SE	38.4	31/12	1015.3
>SMKF1	24.6N	081.1W	0738	27.0	28.1				>10.0	E	29.8	17/13	1014.2
>SPGF1	26.7N	079.0W	0737	26.2	28.1				>7.0	E	36.8	31/05	1014.4
>SRST2	29.7N	094.1W	0734	21.7					>9.4	SE	23.9	08/06	1014.3
>STDM4	47.2N	087.2W	0734	9.6					>18.8	S	40.0	24/01	1014.3
>SUPN6	44.5N	075.8W	0737	10.6	14.6				>8.5	SW	27.8	09/16	1019.3
>SVLS1	32.0N	080.7W	0241	23.0	25.3	1.1	2.7	>12/10	16.7	NE	35.4	11/21	1015.3
>THIN6	44.3N	076.0W	0735	10.1									
>TPLM2	38.9N	076.4W	0667	14.8	17.4				>9.8	NW	26.5	15/12	1019.1
>TTIW1	48.4N	124.7W	0642	9.9					>11.6	E	44.3	31/12	1015.0
>VENF1	27.1N	082.5W	0118	26.1	27.5				>12.4	E	25.5	02/12	1011.4
>WPOW1	47.7N	122.4W	0736	11.6					>7.8	S	31.4	26/10	1015.8
>DECEMBER 1994													
>32302	18.0S	085.1W	0741	19.6	19.8	1.8	3.0	>20/23	10.5	SE	18.1	27/07	1014.4
>41001	34.7N	072.6W	0740	18.1	21.8	2.5	7.5	>23/08	15.2	NE	36.9	23/00	1018.4
>41002	32.3N	075.2W	0662	20.1	23.4	2.3	7.5	>22/23	14.5	NE	35.2	11/19	1018.4
>41004	32.5N	079.1W	0740	17.2	22.0	1.9	4.9	>24/05	16.4	N	34.6	23/22	1021.3
>41006	29.3N	077.3W	0744	22.0	24.0	2.4	6.8	>22/09	14.8	E	42.7	22/07	1016.6
>41009	28.5N	080.2W	1486	20.6	22.9	1.8	5.2	>22/08	13.7	NW	34.0	24/03	1017.3
>41010	28.9N	078.5W	1485	22.0	24.2	2.3	7.0	>22/06	13.0	E	44.3	22/02	1016.3
>41016	24.6N	076.5W	0736	24.4	26.7	0.6	2.2	>22/03	13.5	E	35.9	22/03	1017.2
>41018	15.0N	075.0W	0739	27.0	27.6	1.7	3.4	>10/15	13.2	E	22.7	10/10	1012.6
>42001	25.9N	089.7W	0741	21.9	24.3	1.2	4.1	>11/20	12.2	NE	29.0	22/22	1018.3
>42002	25.9N	093.6W	0736	22.2	24.4	1.3	4.2	>11/06	12.5	SE	29.1	11/01	1018.0
>42003	25.9N	085.9W	0449	22.5					>6.6	NE	16.0	21/01	1018.8
>42007	30.1N	088.8W	0743	14.5	17.1				>13.0	NE	32.4	11/08	1019.9
>42019	27.9N	095.0W	0383	21.6	24.0	1.3	3.0	>10/23	13.0	SE	27.8	10/17	1018.2
>42020	27.0N	096.5W	0743	20.9	1.3	3.3		>10/23	13.2	SE	27.8	10/21	1018.3
>42035	29.3N	094.4W	0729	16.2	18.3	0.8	2.5	>28/23	12.0	E	26.8	11/00	1019.5
>42036	28.5N	084.5W	0737	19.3	22.5	1.0	3.2	>24/00	12.2	NE	26.2	23/23	1019.3
>42037	24.5N	081.4W	0742	23.2	25.6	0.8	2.6	>21/15	11.0	N	25.6	23/09	1016.7
>44004	38.5N	070.7W	0738	13.5	20.5	2.8	11.6	>23/18	16.5	NE	53.4	23/17	1019.0
>44005	42.9N	069.0W	0738	4.6	8.5	2.2	7.5	>24/06	16.9	NW	37.7	29/21	1019.8
>44007	43.5N	070.2W	0553	1.3	7.3	0.9	4.6	>24/12	11.9	N	31.5	30/08	1021.4
>44008	40.5N	069.4W	0738	7.8	10.4	2.4	10.7	>23/22	12.7	SW	30.5	08/11	1019.3
>44009	38.5N	074.7W	0737	9.0	11.0	1.6	5.4	>23/19	13.8	N	30.3	08/07	1021.3
>44011	41.1N	066.6W	0742	6.7	8.7	2.8	7.2	>23/22	14.5	NE	30.5	23/20	1017.9
>44013	42.4N	070.7W	0737	4.5	1.2	6.7		>24/07	14.7	W	40.4	24/05	1020.2
>44014	36.6N	074.8W	0727	13.0	2.0	6.0		>24/03	11.2	N	15.0	01/02	1020.4
>44025	40.3N	073.2W	0741	7.2	10.2	1.5	5.9	>24/05	15.3	NW	37.7	24/03	1020.9
>44028	41.4N	071.1W	0740	4.9	7.9	0.9	4.1	>24/04	16.4	N	51.1	24/04	1020.4
>46001	56.3N	148.2W	0734	4.7	3.8	9.2		>03/23	17.2	SW	40.4	03/21	995.0
>46002	42.5N	130.3W	0738	10.7	12.2	4.4	8.1	>16/10	18.0	SW	31.7	17/08	1013.3
>46003	51.9N	155.9W	0740	3.6	4.7	4.5	10.7	>05/03	18.9	W	40.2	05/02	996.5
>46005	46.1N	131.0W	0741	8.7	9.8	4.5	8.6	>16/09	18.7	S	36.1	12/01	1009.2
>46006	40.9N	137.5W	0738	11.8	12.9	4.8	8.9	>22/09	19.2	W	38.7	30/21	1014.3
>46011	34.9N	120.9W	0735	12.2	13.2	2.7	5.3	>07/23	9.4	NW	24.3	25/02	1018.2
>46012	37.4N	122.7W	0425	12.2	2.3	4.9		>17/09	8.8	NW	23.9	03/12	1019.7
>46013	38.2N	123.3W	0739	9.9	11.4	3.0	5.5	>17/04	12.2	NW	29.1	25/17	1019.7
>46014	39.2N	124.0W	0733	9.9	11.2	3.3	6.1	>18/23	11.2	SE	27.4	11/20	1019.2
>46022	40.8N	124.5W	0727	9.9	10.9	3.5	6.1	>07/07	14.1	S	31.1	16/05	1017.8
>46023	34.3N	120.7W	0427	12.7	13.4	3.3	5.9	>19/10	1018.2				
>46025	33.8N	119.1W	0463	14.2	14.8	1.1	1.9	>08/14	6.4	NW	25.3	08/14	1017.7
>46026	37.8N	122.8W	0736	10.1	10.9	2.4	4.8	>19/02	10.8	E	25.5	25/01	1019.2
>46027	41.9N	124.4W	0408	8.6	9.8	3.1	6.5	>16/23	13.3	SE	29.5	11/18	1017.5
>46028	35.8N	121.9W	0741	12.1	3.0	6.4		>07/23	11.0	NW	28.2	25/17	1019.2
>46029	46.2N	124.2W	0738	8.8	8.4	3.7	7.8	>20/00	1013.9				
>46030	40.4N	124.5W	0740	9.7	10.9	3.2	6.5	>17/00	14.8	SE	33.8	14/15	1017.9
>46035	57.0N	177.7W	0720	3.1	3.5	9.6		>08/06	19.8	NE	43.5	28/12	989.9
>46041	47.4N	124.5W	0731	6.9	8.7	3.4	7.3	>19/19	16.0	SE	36.5	20/01	1012.7
>46042	36.8N	122.4W	0738	11.2	12.4	2.9	5.9	>17/08	10.4	NW	27.0	25/12	1019.2
>46045	33.8N	118.5W	0737	13.4	14.4	0.9	2.3	>26/04	6.0	E	17.5	07/15	1017.4
>46050	44.6N	124.5W	0506	8.6	3.9	7.8		>20/01					1013.8
>46053	34.2N	119.9W	0744	13.4	14.0	1.6	3.5	>25/19	7.1	W	28.0	25/14	1018.6
>46054	34.3N	120.5W	0743	12.9	13.4	2.6	5.5	>19/13	12.3	NW	34.4	26/04	1018.5
>46059	38.0N	130.0W	0736	13.1	14.4	3.9	7.3	>18/18	16.0	NW	28.8	23/19	1018.7
>51001	23.4N	162.3W	0740	23.4	24.6	3.4	6.4	>20/00	15.1	E	28.6	29/00	1019.2
>51002	17.2N	157.8W	0743	24.4	25.1	3.4	5.7	>11/15	18.8	E	28.1	10/09	1016.0
>51003	19.1N	160.8W	0044	26.1	2.7	3.5		>03/02	15.1	E	20.1	04/05	1014.5
>51004	17.4N	152.5W	0739	24.9	3.2	5.1		>10/22	18.6	NE	26.2	11/08	1017.6
>51026	21.4N	156.9W	0491	23.0	23.9	3.1	5.0	>20/09	19.5	E	29.1	11/12	1018.7
>51027	20.5N	157.1W	0597	23.6	24.4	1.9	3.3	>11/19	15.7	E	30.7	09/16	1017.6
>91222	18.1N	145.8E	0628	26.1					>8.4	NE	23.4	23/00	1013.3
>91251	11.4N	162.4E	0395	27.7					>18.0	NE	33.0	19/17	1008.4
>91328	8.6N	149.7E	0741	27.7					>9.5	NE	21.5	15/09	1010.0
>91338	5.3N	153.7E	0369	27.9					>4.4	NE	15.5	14/03	1007.6
>91343	7.6N	155.2E	0740	28.0					>9.6	NE	28.7	12/21	1007.6
>91352	6.2N	160.7E	0710	27.4					>8.5	NE	35.1	19/15	1009.0

October, November and December 1994

>BUOY	LAT	LONG	OBS	>MEAN AIR TP >(C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	>MAX SIG >WAVE HT >(DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
>91355	5.4N	163.0E	0742	27.2					>7.6	E	37.9	19/13	1006.8
>91377	6.1N	172.1E	0341	27.5					>9.1	NE	25.3	17/15	1009.5
>ABAN6	44.3N	075.9W	0740	-1.1	4.9				>4.4	N	22.2	24/08	
>ALSN6	40.5N	073.8W	0742	5.8	9.3	1.1	4.2	>24/04	16.0	NW	44.0	24/10	1021.8
>BURL1	28.9N	089.4W	0737	15.6					>12.7	NE	32.1	23/01	1019.3
>CARO3	43.3N	124.4W	0742	7.9					>12.4	S	32.7	27/01	1015.7
>CHLV2	36.9N	075.7W	0742	10.1					>16.6	N	34.8	23/22	1021.5
>CLKN7	34.6N	076.5W	0742	12.6					>13.5	NE	33.5	24/01	1020.8
>CSBF1	29.7N	085.4W	0739	14.3					>6.0	NE	19.1	11/00	1020.1
>DBLN6	42.5N	079.4W	0741	2.7					>10.7	SW	34.3	11/17	1022.5
>DESW1	47.7N	124.5W	0737	6.4					>18.5	SE	47.8	19/14	1012.7
>DISW3	47.1N	090.7W	0742	-2.1					>10.8	SW	28.5	10/23	
>DPIA1	30.3N	088.1W	0742	13.7					>10.9	NE	31.9	11/10	1020.6
>DRYF1	24.6N	082.9W	0742	23.2	25.0				>12.5	NE	33.4	21/14	1017.0
>DSLN7	35.2N	075.3W	0743	15.5					>20.1	N	49.6	24/00	1020.3
>FBIS1	32.7N	079.9W	0743	12.6					>10.7	NE	27.7	30/12	1019.8
>FFIA2	57.3N	133.6W	0740	2.1					>15.8	N	41.9	02/11	1004.3
>FPSN7	33.5N	077.6W	0612	16.6					>20.0	N	52.2	24/06	1018.7
>FWYF1	25.6N	080.1W	0740	22.8	25.6				>13.6	E	44.4	21/18	1017.1
>GDIL1	29.3N	090.0W	0736	15.1	16.6				>11.0	NE	35.1	11/07	1020.3
>GLLN6	43.9N	076.5W	0742	0.9					>13.4	NE	37.2	11/20	1022.1
>IOSN3	43.0N	070.6W	0743	2.8					>15.8	NW	45.7	24/07	1020.2
>LKWF1	26.6N	080.0W	0743	21.3	24.3				>10.6	NW	43.6	21/21	1017.9
>LONF1	24.9N	080.9W	0722	22.5	23.4				>11.0	N	28.9	21/05	1016.8
>MDRM1	44.0N	068.1W	0743	2.4					>19.4	NW	46.5	29/23	1019.1
>MISM1	43.8N	068.9W	0741	2.4					>18.6	NW	43.9	30/01	1019.8
>MLRF1	25.0N	080.4W	0732	23.1	25.6				>12.8	E	36.2	21/22	1015.4
>NWPO3	44.6N	124.1W	0737	7.5					>13.1	E	38.7	16/04	1015.0
>PILM4	48.2N	088.4W	0741	-1.4					>14.5	SW	34.7	11/06	1020.4
>PTAC1	39.0N	123.7W	0740	8.6					>9.3	SE	28.8	24/00	1019.1
>PTAT2	27.8N	097.1W	0742	16.8	18.1				>10.3	N	30.4	28/11	1018.8
>PTGC1	34.6N	120.7W	0738	12.0					>12.2	N	37.3	25/04	1017.8
>ROAM4	47.9N	089.3W	0742	-1.7	3.6				>15.8	SW	38.6	22/01	1020.3
>SANF1	24.5N	081.9W	0737	23.2	25.4				>13.5	NE	34.2	23/20	1016.8
>SAUF1	29.9N	081.3W	0740	15.6	17.5				>10.9	N	27.1	13/01	1019.1
>SBIO1	41.6N	082.8W	0744	2.6					>10.1	S	28.0	11/03	1023.2
>SGNW3	43.8N	087.7W	0739	0.2	3.1				>10.1	SW	25.9	07/16	1023.6
>SISW1	48.3N	122.9W	0741	6.0					>15.9	SE	43.4	19/12	1013.4
>SMKF1	24.6N	081.1W	0738	23.0	25.1				>13.6	NE	38.6	21/16	1017.1
>SPGF1	26.7N	079.0W	0743	22.8	25.1				>9.3	E	36.8	22/01	1017.0
>SRST2	29.7N	094.1W	0742	13.6					>8.7	E	30.2	28/23	1020.1
>STDM4	47.2N	087.2W	0742	0.2					>16.6	S	40.2	28/11	1020.1
>SUPN6	44.5N	075.8W	0743	-1.1	5.1				>9.4	NE	25.9	29/14	1023.7
>SVLS1	32.0N	080.7W	0713	14.1	18.1	1.0	2.3	>09/03	16.1	NE	33.0	30/20	1019.6
>THIN6	44.3N	076.0W	0213	2.5									
>TPLM2	38.9N	076.4W	0739	6.6	7.8				>10.6	N	36.2	24/18	1022.6
>TTIW1	48.4N	124.7W	0738	6.4					>20.1	E	53.5	19/15	1012.3

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The *Imperator Alexander*

Teresa Fremaux
The Mariners Museum
Newport News, Virginia

Titled "The ***Imperator Alexander*** under Sail in Heavy Seas Taking On Water, 1931," the photograph above is from the Museum's Edwin Levick Collection. Because it was taken after Edwin's death, the photo is credited to his son, John, or someone else in Levick's company.

In the 1950's, a collector discovered thousands of Levick's negatives and photographs gathering dust in anonymous file cabinets, forgotten for 30 years.

In the era before small, fast-action cameras, Levick's photographed yachting events and built his reputation with his coverage of the America's Cup races. Holding a clumsy view camera, he would stand on a heaving boat, relying on a slow shutter and lens to capture an equally lurching subject. With these handicaps, his yachting photos take on a special significance.

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